# Eighteenth

# Vermont Agricultural Report

BY THE

# State Board of Agriculture

FOR THE YEAR

# 1898.

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## Victor I. Spear,

**Secretary of the Board.**


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1898.

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# Members

OF THE

# State Board of Agriculture, 1898.

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HIS EXCELLENCY, JOSIAH GROUT, Derby, *Chairman*.

MATTHEW H. BUCKHAM, President University of Vermont and State Agricultural College, Burlington.

VICTOR I. SPEAR, East Braintree, *Secretary*.

F. C. WILLIAMS, Coventry, *Assistant Secretary*.

J. O. SANFORD, Stamford.

PROF. J. L. HILLS, Burlington.

ALPHA MESSER, Rochester.

C. J. BELL, Walden, P. O., East Hardwick.

JAMES K. CURTIS, Georgia, P. O., St. Albans.

J. H. WARE, Townshend.

# FORMER MEMBERS

OF THE

# State Board of Agriculture.

1871–72.

His Excellency, JOHN W. STEWART.
JAMES B. ANGELL, President State Agricultural College.
*PETER COLLIER, Secretary of the Board.

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| A. B. HALBERT, Essex. | *PITT W. HYDE, Castleton. |
| *CHARLES H. HEATH, Plainfield. | *Z. E. JAMESON, Irasburgh. |
| FREDERICK HOLBROOK, Brattleboro. | NOAH B. SAFFORD, W. R. Junction. |

1873–74.

*His Excellency, JULIUS CONVERSE.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
*PETER COLLIER, Secretary of the Board.

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| A. B. HALBERT, Essex. | *PITT W. HYDE, Castleton. |
| *CHARLES H. HEATH, Montpelier. | *Z. E. JAMESON, Irasburgh. |
| *FRANCIS D. DOUGLAS, Whiting. | THOS. H. HOSKINS, Newport. |

1875–77.

His Excellency, ASAHEL PECK.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
*PETER COLLIER, Secretary of the Board.

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| THOMAS L. SHELDON, Rupert. | *C. HORACE HUBBARD, Springfield. |
| ALEXIS T. SMITH, New Haven. | GARDNER S. FASSETT, Enosburgh. |
| *JOHN B. MEAD, Randolph. | CYRUS G. PRINDLE, Charlotte. |

JOHN H. MEAD, West Rutland.

1877–78.

His Excellency, HORACE FAIRBANKS.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
HENRY M. SEELEY, Secretary of the Board.

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| GARDNER S. FASSETT, Enosburgh. | *JOHN H. MEAD, West Rutland. |
| *PETER COLLIER, Burlington. | *ORA PAUL, Pomfret. |
| *ALBERT CHAPMAN, Middlebury. | HENRY CHASE, Lyndon. |

1879–80.

Under change of law, JOHN B. MEAD, of Randolph, was "Superintendent of Agricultural Affairs."

1881–82.

His Excellency, ROSWELL FARNHAM.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
*HIRAM A. CUTTING, Secretary of the Board.

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| *HENRY LANE, Cornwall. | *H. F. LOTHROP, Pittsford. |
| *E. M. GOODWIN, Hartland. | GARDNER S. FASSETT, Enosburgh. |
| *M. W. DAVIS, Westminster. | E. R. TOWLE, Franklin. |

E. R. PEMBER, Wells.

*Dead.

1883–84.

His Excellency, JOHN L. BARSTOW.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
*HIRAM A. CUTTING, Secretary of the Board.
*HENRY LANE, Cornwall. | E. R. PEMBER, Wells.
*E. M. GOODWIN, Hartland. | E. R. TOWLE, Franklin.
*M. W. DAVIS, Westminster.

1885–86.

His Excellency, SAMUEL E. PINGREE.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
*HIRAM A. CUTTING, Secretary of the Board.
*HENRY LANE, Cornwall. | E. R. TOWLE, Franklin.
*M. W. DAVIS, Westminster. | *F. D. DOUGLAS, Whiting.
*A. E. PERKINS, Pomfret.

1887–88.

His Excellency, EBENEZER J. ORMSBEE.
MATTHEW H. BUCKHAM, Pres, State Agricultural College.
W. W. COOKE, Secretary of the Board.
*HENRY LANE, Cornwall. | H. H. HILL, Isle LaMotte.
*M. W. DAVIS, Westminster. | R. C. SMITH, Pittsford.
*D. L. CUSHING, Quechee. | H. W. VAIL, Pomfret.
WILLIAM CHAPIN, Middlesex.

1889–90.

His Excellency, WILLIAM P. DILLINGHAM.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
W. W. COOKE, Secretary of the Board.
*M. W. DAVIS, Westminster. | H. W. VAIL, Pomfret.
R. C. SMITH, Pittsford. | WM. CHAPIN, Middlesex.
C. M. WINSLOW, Brandon.

1891–92.

His Excellency, CARROLL S. PAGE.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
W. W. COOKE, Secretary of the Board.
R. C. SMITH, Pittsford. | H. W. VAIL, Pomfret.
WM. CHAPIN, Middlesex. | J. O. SANFORD, Stamford.
VICTOR I. SPEAR, Braintree.

1893–94.

*His Excellency, LEVI K. FULLER.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
C. M. WINSLOW, Brandon, Secretary of the Board.
VICTOR I. SPEAR, Braintree, Statistical Secretary.
H. W. VAIL, Pomfret. | Prof. J. L. HILLS, Burlington.
J. O. SANFORD, Stamford. | *H. M. ARMS, Springfield.

1895–96.

His Excellency, URBAN A. WOODBURY.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
C. M. WINSLOW, Brandon, Secretary of the Board.
VICTOR I. SPEAR, Braintree, Statistical Secretary.
H. W. VAIL, Pomfret. | Prof. J. L. HILLS, Burlington.
J. O. SANFORD, Stamford. | *H. M. ARMS, Springfield.
F. C. WILLIAMS, Coventry.

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*Dead.

## CHAPTER 21.

### BOARD OF AGRICULTURE.



SEC. 245. The Governor, the President of the University of Vermont and State Agricultural College, and six other persons appointed by the Governor, and confirmed by the senate during each biennial session of the General Assembly and who shall hold their office for the term of two years from and after the first day of December in the year in which the appointment is made, shall constitute the Board of Agriculture for the improvement of the general interests of husbandry, the promotion of agricultural education throughout the State, and for the discharge of such other duties as are hereinafter set forth; vacancies in the Board shall be filled by the Governor. Said Board shall appoint from its number a Secretary. The Governor may, whenever in his discretion he deems the public good requires it, increase said Board by appointing one or two additional members to serve during the whole or any part of the biennial term for which the Board is appointed.

SEC. 246. The Board shall hold one meeting in each county annually and others if deemed expedient, and may employ lecturers, essayists or other aid in conducting said meetings, managing its affairs generally and discharging its duties. At such meetings it shall present subjects for discussion, and among other topics forestry and tree planting, roads and road making.

SEC. 247. The Secretary shall prepare on or before the thirtieth day of June annually, a detailed report of the proceedings of the Board, with such suggestions in regard to its duties, and the advancement of the interests herein specified as may seem pertinent; and he may append thereto such abstracts of the proceedings of the several agricultural societies and farmers' clubs in the State as may be advisable. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

SEC. 248. The Board shall collect authentic statistical information, as full as possible, relating to agriculture and agricultural products, farms and farm property, the manufacturing and mining industries of the State, which, under a separate head, shall form a part of its annual report; and such information shall be complete as to unoccupied farms. The Board shall also publish such information in separate form, showing by description and illustration, the resources and attractions of Vermont; also the advantages the State offers and invitations it extends to capitalists, tourists, and farmers; and shall distribute the same in such manner as, in its judgment, will be most effective in developing the resources and advertising the advantages of the State.

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## AN ACT TO PROVIDE FOR THE PRINTING OF THE REPORT OF THE VERMONT DAIRYMEN'S ASSOCIATION.

*It is hereby enacted by the General Assembly of the State of Vermont:*

SECTION 1. Section two hundred and forty-seven of the Vermont Statutes shall be amended so as to read as follows:

The Secretary shall prepare on or before the 30th day of June annually, a detailed report of the proceedings of the Board with such suggestions in regard to its duties and the advancement of the interests herein specified as may seem pertinent, and he may append thereto such abstracts of the proceedings of the several agricultural societies, and farmers' clubs in the State as may be advisable and the report of the Vermont Dairymen's Association. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

SEC. 2. The provision of section two hundred and fifty-one of Vermont Statutes requiring the printing of a report by the Vermont Dairymen's Association is hereby repealed.

Approved November 24, 1896.

## CHAPTER 203.

### PRESERVATION OF CATTLE AND SHEEP.



SECTION 4802. If sheep are affected with the "hoof ail" or "foot rot," or with the "scab" the owner or keeper thereof shall restrain them from running at large in the public highways or commons, and keep them in an enclosure; and if he, knowing them to be diseased, knowingly permits them to go at large upon a common or public highway, or if such sheep, while so diseased, are found in an enclosure other than that of such owner or keeper, he shall be fined ten dollars, to the use of the town where such offense is committed, and shall also be liable to the party injured for the damages sustained, in an action upon this statute.

SEC. 4803. If sheep, infected with the "hoof ail" or "foot rot," are found at large upon a common, public highway, or lane, or lands not owned or occupied by their owner or keeper, through the neglect of such owner or keeper, said sheep shall become forfeit to any person who takes them up, and the owner of such sheep shall not have an action at law or equity for their recovery.

PLEURO-PNEUMONIA AND OTHER INFECTIOUS DISEASES.

SEC. 4804. If a person drives or brings domestic animals into this State, or is accessory thereto, knowing that any of them have the disease, or have been exposed to the disease, known as pleuro-pneumonia, he shall be fined not more than five hundred dollars, or be imprisoned not more than twelve months and not less than one month, in the discretion of the court.

SEC. 4805. A town, at a meeting held for that purpose, may establish regulations, appoint officers or agents, and raise and appropriate money to arrest and prevent the spread of the cattle disease known as pleuro-pneumonia.

SEC. 4806. The selectmen may perform all acts and make all rules and regulations for and in behalf of the town, necessary to carry into effect the powers conferred on the town by this chapter, until the town otherwise orders at a meeting holden for that purpose.

SEC. 4807. If a person brings into this State any domestic animals which he knows to be infected with an infectious or contagious disease, or exposes such cattle or other animals known to him to be so infected, to other cattle and animals not infected with such disease, he shall be fined not more than five hundred dollars, and not less than one hundred dollars.

SEC. 4808. The selectmen of the towns and the board of aldermen of the cities of this State, may make and enforce such regulations as they deem proper, to prevent the spread of infectious or contagious diseases among domestic animals, within their respective towns and cities, and shall inquire into all such cases coming to their knowledge, and shall immediately report the same to the governor. A person who knowingly violates or refuses to obey such regulations made by such town or city authorities, shall be fined one hundred dollars.

BOARD OF AGRICULTURE

SEC. 4809. The Board of Agriculture may prohibit the introduction of horses or other domestic animals, believed to be

infected with or exposed to any contagious disease, into this State, or may quarantine all such animals for such time as the public good requires; but shall not prohibit the transportation of the same in cars through this State.

SEC. 4810. If a person violates such order, after the same has been published three successive days in such newspapers published in this State as the Board directs, he shall be fined not more than three hundred dollars for each offense, and every officer or agent of any company or other person who violates such order, shall be fined as aforesaid. The introduction into this State at the same time of a number of horses, cattle or other domestic animals, contrary to the orders of such Board, shall be deemed a separate and distinct offense for each animal.

SEC. 4811. The Board shall endeavor to obtain full information in relation to any contagious disease which may prevail among domestic animals near the borders of the State, and publish and circulate such information at their discretion; and should any such disease break out, or should there be reasonable suspicion of its existence among cattle or other domestic animals, in any town in this State, they shall examine the cases and publish the results of their examination for the benefit of the public. The Board is also authorized to examine under oath, in the several towns and cities in this State, all persons possessing or believed to possess knowledge of any material facts concerning the existence or dissemination or danger of dissemination of diseases among domestic animals, and for this purpose shall have all the power now conferred upon justices of the peace to compel witnesses to attend and testify.

SEC. 4812. All costs and expenses incurred in procuring the attendance of such witnesses shall be allowed by the State auditor, upon the approval of the Governor, and be paid by the State.

SEC. 4813. When bovine tuberculosis or any contagious disease exists in the State among cattle or other domestic animals, the Board of Agriculture may quarantine all infected animals or such as they suppose have been exposed to the contagion, may prohibit any animal from passing on or over any of the highways

near the place of quarantine, may enter upon any premises where there are animals suspected to have bovine tuberculosis or any contagious disease, may employ such expert help and means as they deem necessary to a thorough investigation of such diseases, may make all investigations and regulations they deem necessary for the detection, prevention, treatment, cure and extirpation of such disease, but shall not apply the tuberculin test without the consent of the owner of the cattle, but in quarantine regulations against cattle imported from without the State the tuberculin test may be applied, and they may condemn and order killed any cattle or other domestic animals believed by said board to be infected with bovine tuberculosis or any contagious disease, and may order the bodies of the same buried or burned, as in their judgment the case may require; may forbid the sale or removal from the premises of any dairy product from cows that are believed to have bovine tuberculosis. Any person who shall knowingly violate or refuse to comply with any order or regulation of such board, made under the authority of this section, shall be fined not more than two hundred dollars, or be imprisoned not more than two years, or both.

SEC. 4814. If any person shall sell or offer to sell any cattle or other domestic animal known to him to be infected with bovine tuberculosis or any contagious disease, or any disease dangerous to the public health, or shall sell or offer to sell any part or parts of such cattle or other domestic animals, he shall be fined not more than two hundred dollars or be imprisoned not more than two years, or both.

SEC. 4815. The value of all cattle or other domestic animals killed by the written order of the board of agriculture shall be appraised by one of said board and a disinterested person selected by the owner of the condemned animals, if these two cannot agree upon the amount of the appraised value of the animal, they shall select a third disinterested person, who together with them shall appraise the animal, such appraisal to be made just before killing, and on a basis of health. The limit of the appraisal of cattle shall be forty dollars. A *post mortem* examination

shall be made, and if the animal be found affected with bovine tuberculosis, or any disease dangerous to the public health, the owner of the animal shall receive one-half the appraised value; but if no bovine tuberculosis or disease dangerous to the public health be found, the owner of the animal shall receive the full amount of the appraisal, and in addition shall receive the slaughtered animal. The amount which the owner is entitled to receive shall be paid by the State to the owner of such animal or animals upon a written order, signed by the member of the board in charge, and countersigned by the secretary of said board. No indemnity shall be paid to the owner of condemned cattle or other domestic animals that have not been owned and kept in the State for at least six months previous to the discovery of the disease. Any person who shall knowingly violate, or refuse to comply with any regulations made by such board of agriculture, under the authority and provisions of this section, shall be fined not more than two hundred dollars, or imprisoned not more than two years, or both.

SEC. 4816. All expenses incurred by the board under the provisions of this act shall be allowed by the state auditor, upon the approval of the Governor, and be paid by the State.

SEC. 4817. Whenever the board shall make and publish regulations concerning the extirpation, cure or treatment of domestic animals infected with, or which have been exposed to, any contagious disease, such regulations shall supersede the regulations made by the selectmen of the several towns, or the board of aldermen of the several cities, upon the same subject; and the operation of such regulations made by said authorities, shall be suspended during the time those made by the board as aforesaid are in force.

SEC. 4818. The board shall keep a record of its doings and report the same to the governor, prior to the fifteenth day of September, annually, unless sooner required.

SEC. 4819. All orders, appointments and notices from the board shall be signed by a majority of the same.

SEC. 4820. Every prosecution for a violation of any of the provisions of this chapter, shall be commenced within sixty days from the commission thereof.

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AN ACT TO AMEND SECTION 4820 OF CHAPTER 203 OF THE VERMONT STATUTES, RELATING TO PRESERVATION OF CATTLE AND SHEEP.

*It is hereby enacted by the General Assembly of the State of Vermont:*

SECTION 1. Section four thousand eight hundred and twenty of the Vermont Statutes is hereby amended so as to read as follows:

Every prosecution for a violation of any of the provisions of this chapter, shall be commenced within six months from the commission thereof.

SEC. 2. This act shall take effect from its passage.

Approved November 7, 1896.

# CHAPTER 183.

## REGULATING MANUFACTURE AND SALE OF PROVISIONS.



### MILK AND CHEESE.

SECTION 4327. A person who sells or furnishes, or has in his possession with intent to sell or furnish, milk diluted with water, adulterated, or not of good standard quality; or from which the cream or any part has been taken, or keeps back part of the milk known as "strippings" shall, for each offense, be fined not more than three hundred dollars and not less than fifty dollars.

SEC. 4328. In all creameries and cheese factories in this state milk containing four per cent. of butter fat shall be the standard used as a paying basis.

SEC. 4329. Where, in prosecutions under the preceding section the ordinary means of proof are not available or sufficient, sealed samples of the milk sold or furnished, or kept with intent to be sold or furnished, taken from such milk in the presence of at least one disinterested witness and with the knowledge and in the presence of the person or his agent or servant so selling or furnishing, or having in his possession with intent to sell or furnish said milk, may be sent to the state agricultural experiment station to be tested; the result of such test shall be deemed competent evidence in such prosecutions but shall not exclude other evidence.

SEC. 4330. Said samples shall be placed in tin or glass vessels securely sealed with a label thereon stating the time when, place where, the sample was drawn, from whose milk taken, and signed by the person taking the same and by one or more disinterested witnesses. Upon request a like sample shall be given to such person, his agent or servant, for which a receipt shall be given to the person taking or drawing the same.

SEC. 4331. Standard milk shall contain not less than twelve and one-half per cent. of solids, or not less than nine and one-fourth of total solids exclusive of fat, except in the months of May and June, when it shall contain not less than twelve per cent. of total solids. This rule shall govern tests made at the experiment station, and an officer or employee thereof found guilty of fraud in making tests shall be fined one thousand dollars.

SEC. 4332. A person who marks or otherwise designates or causes to be marked or otherwise designated as "creamery" butter or cheese, or the packages in which it is contained, when such butter or cheese is not manufactured at a creamery, or sells or offers to sell any such butter or cheese so marked, shall be fined not more than three hundred dollars and not less than fifty dollars.

SEC. 4333. Justices shall have concurrent jurisdiction with the county court in prosecutions under the four preceding sections.

### IMITATIONS OF BUTTER AND CHEESE.

SEC. 4334. No person by himself, his agent, or servant, shall manufacture out of animal fat, or animal or vegetable oils not produced from unadulterated milk or cream, any article in imitation of butter or cheese, or mix with or add to milk, cream or butter any acids or other deleterious substances, animal fats, or animal or vegetable oils so as to produce an article in imitation of butter or cheese.

SEC. 4335. If a person violates the provisions of the preceding section he shall be fined not more than three hundred dollars, and not less than one hundred dollars, or be imprisoned for not more than one year and not less than six months for the first offense ; and for each subsequent offense shall be fined not

more than one thousand dollars and not less than three hundred dollars, or imprisoned for one year. One-half of the fine shall go to the complainant.

SEC. 4336. If a person by himself, his agent, or servant, sells, exposes for sale, or has in his possession with intent to sell, any article made in imitation of butter, that is of any other color than pink, shall, for every package sold or exposed for sale, be fined fifty dollars, and for each subsequent offense one hundred dollars. One-half of the fine shall go to the complainant.

SEC. 4337. If a proprietor or keeper of a hotel, restaurant, boarding house, eating saloon or other place where food is furnished to persons paying for the same, places upon the table or has in his possession with intent to use, any article made in imitation of butter, that is of any other color than pink, he shall be fined fifty dollars for the first offense, and for each subsequent offense one hundred dollars. One-half of the fine shall go to the complainant.

SEC. 4338. The complainant may cause specimens of suspected butter or cheese to be analyzed or otherwise tested as to color and compounds; the expense of such analysis or test not exceeding twenty dollars, in any one case, may be included in the cost of prosecution.

SEC. 4339. A justice of the peace may issue a warrant for searching, in the day-time, any store, hotel, boarding house, or other place where oleomargarine, butterine or other substance imitating butter or cheese is suspected to be kept or concealed, when the discovery of such articles may tend to convict a person of any offense under the five preceding sections. No warrant shall be issued except upon the oath of some person that he has reason to suspect and does suspect that such article or articles are kept or concealed in the place to be searched.

SEC. 4340. The term "butter" shall mean the product usually known by that name, manufactured exclusively from milk or cream, or both, with or without salt or coloring matter.

## LARD.

SEC. 4341. No person by himself, his agent or servant, shall prepare, sell or expose for sale lard or any substance intended for use as lard, which contains any ingredient but the pure fat of swine, in any tierce, bucket, pail or other package under a label bearing the words "pure," "refined" or "family," alone or in combination with other words, unless the package containing the same bears upon the outside thereof, in letters not less than one-fourth of an inch long, the words, "Compound Lard."

SEC. 4342. A person violating the provisions of the preceding section shall be fined not more than fifty dollars for each offense.

## MAPLE SUGAR AND HONEY.

SEC. 4344. A person who adulterates maple sugar, maple syrup, or bees' honey with cane sugar, glucose, or any substance whatever, for the purpose of sale, or who knowingly sells maple sugar, maple syrup or bees' honey that has been adulterated, shall be punished by a fine of not more than two hundred dollars and not less than fifty dollars for each offense ; one-half of such fine shall go to the complainant.

## CHAPTER 222.

### OFFENSES AGAINST PUBLIC HEALTH.

SEC. 5073. A person who knowingly sells diseased, corrupted or unwholesome provisions, for food or drink, shall be imprisoned not more than six months, or fined not more than three hundred dollars.

SEC. 5074. A person who kills or causes to be killed, with intent to sell the meat thereof for family use, a calf less than four weeks old, or knowingly sells or has in his possession such meat with intent to sell the same in the State, or to send the same for such use to any foreign market, shall be punished as provided in the preceding section.

# CHAPTER 184.

## COMMERCIAL FERTILIZERS.



SECTION 4346. The term "commercial fertilizer" as used in this chapter shall mean compounds and manufactured substances containing or represented as containing, two or more of the following ingredients, namely: nitrogen, ammonia, potash and phosphoric acid, but shall not apply to the separate ingredients used to manufacture the same, or to bone meal, land plaster, lime, or any substance the product of nature, which has not been compounded.

SEC. 4347. The term "importer" as used in this chapter shall mean a person who procures or sells fertilizers made in other states.

SEC. 4348. Every lot or parcel of commercial fertilizer, or material used for manurial purposes, sold, or exposed for sale, the retail price of which is ten dollars or more per ton, shall be accompanied by a plainly printed statement, clearly and truly certifying the number of net pounds of fertilizer in a package, the name, brand or trade-mark under which the fertilizer is sold, the name and address of the manufacturer or importer, the place of manufacture, and a chemical analysis stating the percentage of nitrogen or its equivalent in ammonia, of potash soluble in distilled water and of phosphoric acid soluble in distilled water and reverted, as well as the total phosphoric acid. Fertilizers composed of other and cheaper materials, shall bear labels giving a correct general statement of the composition and ingredients thereof.

SEC. 4349. Before any commercial fertilizer, the retail price of which is ten dollars or more per ton, is sold, or exposed for sale, the importer, manufacturer or party who causes it to be sold, or offers it for sale, shall file with the director of the agricultural experiment station a certified copy of the statement required by the preceding section, and shall also deposit with said director, at his request, a sealed jar, glass or bottle containing not less than one pound of the fertilizer, accompanied by an affidavit that it is a fair average sample thereof.

SEC. 4350. The manufacturer, importer or agent of a commercial fertilizer or material used for manurial purposes, the retail price of which is ten dollars or more per ton, shall, before the fertilizer is offered for sale, obtain a license from the state treasurer, countersigned by the director of the agricultural experiment station, authorizing the sale of the same in the state, and shall securely affix to each barrel, bag or other package of fertilizer the word "Licensed," with the date of the license. The manufacturer, importer or agent obtaining such license shall pay to the state one hundred dollars for the same and the license shall expire on the thirty-first day of December of the year for which it is issued. One license shall cover all brands manufactured by one party.

SEC. 4351. Manufacturers and importers of a commercial fertilizer sold or offered for sale, the retail price of which is ten dollars or more per ton, shall, before such fertilizer is sold, or exposed for sale, file with the state treasurer a bond, with sureties residing within the state satisfactory to said treasurer, in the sum of one thousand dollars, payable to the state and conditioned for the payment of fines and costs imposed on such manufacturers and importers for violating the provisions of this chapter, and such bond shall be renewed from time to time, as the state treasurer requires.

SEC. 4352. No person shall sell, or expose for sale, any pulverized leather in any form, as a fertilizer, or as an ingredient thereof, without an explicit printed certificate of the fact conspicuously affixed to each package.

SEC. 4353. A person selling or exposing for sale a commercial fertilizer without the statement required by this chapter, or containing a smaller percentage of any one or more of the ingredients named than is specified on the label, or who fails to comply with any of the preceding sections of this chapter, shall be fined fifty dollars for the first offense and one hundred dollars for each subsequent offense. This section shall not affect parties manufacturing, importing or purchasing fertilizers for their own use.

SEC. 4354. Manufacturers and importers of commercial fertilizers or wholesale dealers in the same shall, not later than the first day of February, annually, furnish the director of the agricultural experiment station with the names of the brands offered for sale and their agents in this state, and on the first of each succeeding month until May, such additional agents as in the meantime have been appointed.

SEC. 4355. Said director shall cause one analysis or more of each fertilizer or material used for manurial purposes, to be made annually and the result published monthly. He may, in person or by deputy, take a sample not exceeding two pounds in weight for analysis from any lot or package of fertilizer, or any material used for manurial purposes, which is in the possession of any manufacturer, importer, agent or dealer; but said sample shall be drawn in the presence of the party in interest, or his representative, and shall be taken from a parcel or number of packages which shall not be less than five of the whole lot inspected, and shall be thoroughly mixed and then divided into two equal samples and placed in glass vessels, carefully sealed, and a label placed on each stating the name of the brand of the fertilizer or material sampled, the name of the party from whose stock the sample was drawn, and the time and place of drawing. Said label shall be signed by the director or his deputy and by the party in interest, or his representative present at the drawing and sealing of said samples; one of said duplicate samples shall be retained by the director and the other by the party whose stock was sampled.

SEC. 4356. The director of the agricultural experiment station shall notify the state treasurer of all violations of this chapter and the state treasurer shall commence a suit, in the name of the state, on the bond required to be filed by such manufacturer or importer and prosecute the same to final judgment.

SEC. 4357. Whenever any violations of this chapter are brought to the attention of the state treasurer, he shall give written notice thereof to the manufacturers and importers, and they shall have not less than thirty days thereafter to comply with the requirements of the law.

SEC. 4358. If the fertilizer or fertilizing material is substantially equivalent to the statement of analysis made by the manufacturers or importers, no prosecution shall be had under this chapter. All analyses of fertilizers provided for by this act, including the collection of samples for such analyses, shall be made by the director of the Vermont Agricultural Experiment Station at the expense of said station, and so much of the license fees collected under this act shall be paid by the state treasurer to the treasurer of said station as the director of said experiment station may show by his bills he has expended in performing the duties required by this chapter, but in no case to exceed the amount of the license fees received by the treasurer under this chapter, such payment to be made annually on or after the first day of September, upon the order of the state auditor, who is hereby directed to draw his order for such purpose.

## REPORT OF THE SECRETARY.

*To the Chairman and Members of the Board of Agriculture of the State of Vermont:*

I submit herewith the following report of the work of the Board for the past year, including the Annual Report of the Vermont Dairymen's Association.

### INSTITUTES.

Institutes have been held in all the Counties of the State during the past year with the exception of Essex. It was expected to hold an Institute in this county in the month of March, but unfavorable weather conditions made it seem best to postpone the meeting until summer. The following is a list of the towns and dates of Institutes:

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| Waitsfield | December 14 and 15. |
| Cabot | December 16 and 17. |
| Thetford Hill | December 21 and 22. |
| Randolph | December 22, 23 and 24. |
| Westford | January 11 and 12. |
| East Fairfield | January 12 and 13. |
| North Hero | January 14 |
| Highgate Center | January 13 and 14 |
| Huntington | January 18 and 19. |
| North Ferrisburgh | January 19 and 20. |
| Bridport | January 20 and 21. |
| Brandon | January 25 and 26. |
| Castleton | January 26 and 27. |
| Rupert | January 27 and 28. |
| Readsboro | January 31 |
| Jacksonville | February 1 and 2. |
| Wardsboro | February 2 and 3. |
| Townshend | February 3 and 4. |
| Simonsville | February 8. |
| Pomfret | February 8. |

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|---|---|
| Rochester | February 10 and 11. |
| South Troy | February 15 and 16. |
| Barton Landing | February 16 and 17. |
| Sutton | February 17 and 18. |
| Passumpsic | February 18. |
| East Hardwick | February 21 and 22. |
| Morrisville | February 23, 24 and 25. |

Of the total 27 Institutes it will be noted from the foregoing that 20 were held two days—five one day and two for three days. The three days occupied at Randolph only covered the same number of sessions, viz : six, as the ordinary two days Institute. The closing Institute at Morrisville was a continuation of the plan adopted one year ago of putting extra time, men and expense into our closing meeting, and taking from this meeting most of the papers published in our Report. The experiment was as satisfactory this year as last, and I believe it good policy to give one large Institute during each year, and it comes very properly at the close of the Institute season.

The interest in the meetings held by the Board during the past winter has been fully as good as in previous years. Only a very few of the meetings lacked a good attendance, and in nearly every case where the attendance was light it was due to the storms and the impassable condition of the roads through a portion of the month of February. Some members of the Board were present at every place advertised, but in two or three cases it was not possible for all the members on the programme to be present. The average attendance would not come far from 125, and it was a source of satisfaction to see so many young men in the audiences. The proportion of young men attending these meetings has steadily increased since my connection with this work. It is a source of encouragement to the Board to find this condition, for the reason that any change of methods in work or improvement must come from the young men, if it comes. The old man, though he may possibly realize that there are better methods than he practices, is not likely to break away from habits and methods that have been a lifetime in forming. The presence of so many young men at

the Institutes goes to show also that not all the young men are leaving the farm to engage in other occupations, but that a large per cent. of them are staying in the State and making farming their business.

## CONDITION OF THE FARMING INDUSTRY.

While the present condition of the Farming Industry of Vermont is not all that could be desired, and the farmer to-day who is successful with his business is compelled to practice economy both in personal expenses and in the management of his business, still the condition of farming has improved in several respects over one year ago.

The largest farming industry, dairying, occupies practically the same position as one year ago. The prices of dairy products have ruled low for the past year, and the present outlook does not promise immediate improvement. It is only those dairymen who are using the best dairy animals and feeding intelligently who can produce dairy products at present prices without incurring a loss. The demand for dairy stock has been good for the past year and a large number of cows have been sold at good prices. This demand has led to raising more of this stock and at present prices there is no better business than producing a good grade of dairy cows for supplying the demand in other states. Horses show a little improvement over one year ago. The large surplus of this stock is being reduced and prices at the present time are somewhat better than for the past two years, with a probability of a decided further advance in the near future. *Sheep* have had a decided *boom* in price during the past year. Stock sheep to-day will sell for nearly or quite 100 per cent more than a year ago. The increase in the prices of wool following the enactment of the Dingley tariff brought this stock suddenly into favor and last fall very extreme prices were paid in many localities for a few sheep. There is no industry better adapted to many localities in Vermont than sheep husbandry and a return of this industry is full of promise to the Vermont farmer who conducts it intelligently.

Fruit.—1897 was the off year for the apple orchards of the State. Yet in some sections very full crops were reported and the market returned a high price, leaving a good profit to whoever had apples to sell.

Beef, pork, mutton and poultry all returned to the producer a fair price for 1897 as compared with other recent years. These products, though not produced extensively in Vermont are still produced to some extent in nearly every town and the total received from these sources by Vermont farmers would far exceed the ordinary estimate.

### MAPLE SUGAR.

This is a leading industry in Vermont the average value of the crop being about one million dollars per year. The present condition of this industry is very unsatisfactory and the past two years the general market price for maple sugar has not left to the farmer any profit in producing it. The Maple Sugar Association is trying to secure a better market for this product by establishing a Trade Bureau through which to market it. The farmers have not as yet been willing to co-operate with the Association to the extent necessary to secure the establishment of the Bureau. The trouble with the maple sugar market is the competition of adulterated goods, composed of cane sugar and glucose with a small amount of maple to give it the maple flavor, that is put upon the market and sold as pure maple goods at prices with which it is impossible to compete with maple goods. Unless some remedy is found to take these goods from the market or compel them to sell under their rightful name, the future of the maple sugar industry in Vermont is not very encouraging.

### STATISTICAL WORK.

The collection of the statistics of live stock in Vermont, undertaken last year by Mr. F. C. Williams, Asst. Sec'y, is now nearly complete and it is hoped to have it practically complete for the State before this Report is closed. Also Mr. Williams

has collected very full statistics covering the grain purchased and used in the State which will be given in this Report.

### CATTLE COMMISSIONERS' WORK.

The work of the Board as Cattle Commissioners has been confined largely to testing cattle for tuberculosis. A detailed report of this work will follow under a special head.

V. I. SPEAR,

Secretary.

East Braintree.

# PAPERS, DISCUSSIONS, AND ADDRESSES FROM THE MEETING AT MORRISVILLE, FEB. 23, 24 AND 25, 1898.

## RAISING AND HARVESTING THE CORN CROP.

BY J. K. CURTIS.

MR. PRESIDENT, LADIES AND GENTLEMEN: In the early history of our country, when the colonists began to land upon our shore, touching, as they did, at Charleston, at James River, Plymouth Rock and other points, upon our coast, they found here the plant upon which I am to talk this morning, cultivated by the American Indians with the rude implements of agriculture that they then possessed; and amid all the privations and hardships which those people passed through, they held on to this important plant; and all along through their early history they tied to it as one of the chief products of the soil and as the country has progressed and developed down to the present day this plant has been a mighty factor in the agricultural interests of these United States. There is something wonderful about it. Upon the rugged hillsides of old New England and the sunny plains of the South, the great praries of the west this identical corn-plant thrives to a greater or less extent. No other country has been able to catch on to this important product as has this United States, and to-day, comparatively speaking, the United States of America is one vast grain field. The importance of the crop is recognized all over the world. At this very season of the year the public prints of this country are discussing the probabilities of the crop that is to come next summer; they are discussing the acreage that is to be planted, and the other things which pertain to this crop, and as the season advances it will be watched with interest by every agriculturist in this great country of ours.

So you see that it is one of the important factors in agriculture and one in which every farmer, I may say, in these United States to-day is interested. The old countries have learned, and have come to understand its importance and its value and to-day it is one of the great commodities which is carried through the country and supports largely the railroads and the great commerce of the country which carries it from this to other countries, and is a mighty factor in our national wealth. Millions of bushels are raised and millions of dollars are brought into this country from the result of this great crop, and yet we have not reached its possibilities. We are, comparatively speaking, in the infancy of the crop, and all over the land the interest is increasing from year to year in regard to its importance and in our own State more attention than ever is being paid to this crop as a feed for the dairy cow, and as a great product to feed the flock and the herd and the people.

I do not expect to be able to enter into the discussion of this crop here as well perhaps as it might be done by others who have had larger experience in the raising and handling of the corn-crop, but I shall endeavor, in the few brief remarks I shall make, to give you some ideas that are, in my judgment, essential to the production of a good crop of corn.

We can raise corn in Vermont to-day, more of it to the acre probably than any other State in the Union, and there has been within the last few years large crops of corn raised for husking within the borders of our State. Two years ago a magnificent field of sixty-five acres was grown upon the Billings farm by the manager of that farm, Mr. Aiken. Perhaps it was one of the finest fields of corn and produced the best, or as good results as any field that was ever grown in this State. The land was thoroughly prepared and cultivated, and I have been told, and in fact I have seen on that field of sixty-five acres in one body, where it was marked out by the horse planter, that the rows were as straight as a die. The result that year from that field was something like 11,000 or 12,000 baskets, and besides all that there was the immense amount of fodder that

was secured from the field. Some one might say that upon the Billings farm, with the vast amount of means that a manager might have at his command, he could do better perhaps than the average in the raising of the corn crop, but I have in my mind this morning another field of corn that was raised some three years ago by a young man, or a man of middle age, —I speak of him as a young man because he was a school-mate of mine and I do not realize that I am getting along up into the fifties. This crop of corn was raised in Chittenden County by this gentleman, who hired a farm within the limits of the City of Burlington, which was composed of four hundred acres. The stock upon that farm was sixty-five or seventy cows, the product of those animals being sold in the city of Burlington, in milk, cream and butter. He paid for the use of this farm $1900 per year, and it would seem almost impossible in these times that a man could afford to pay that amount for the use of a farm, but it was a valuable farm, lying upon the river, and every inch of it was good soil. He raised there a crop of some 1300 bushels of Sanford corn which he sold shelled at one dollar a bushel for seed. In spite of the fact that in our own State we can raise these excellent crops of corn, especially in the Champlain Valley, yet we bring into this State annually more than a 1000 bushels of Sanford corn and 5000 or 6000 bushels of other varieties for seed. And yet farmers persist upon going outside of the State and paying one dollar a bushel for this corn when it might just as well be raised in the State. A gentleman told me last night, as I visited his farm, that in such a year even as it was last season for the corn crop, he raised a sufficient amount for the seed next year. If the farmers of Vermont would only wake up to the opportunities which lie around them, we should find different results in many localities with regard to the interests of agriculture.

Now I have cited two large fields of corn raised within our borders, within the last two or three years. All over the State corn is being more and more extensively raised for a crop, and, as my friend, the President of this meeting, has well

said, perhaps it is of more importance to us as a fodder crop, and we are learning from year to year something of its value as a feed for the dairy cow. In order to grow this crop successfully and get the best results from our labor it requires some thought, care and skill. Now I am not going to attempt to lay down any fixed rule to govern you in the raising of the corn crop, for in the locality in which you may reside you may be placed under different circumstances than I am where I live, and you may be obliged under certain conditions to till this crop differently than I would. Since 1880 I have practiced the raising of Sanford corn on my farm for the purpose of ensilage to feed to the dairy cow for the production of milk during the winter months.

Perhaps here I might digress from my subject a little and speak of the importance of the farmer's having a business the year around. It is hard work for us to get out of the old ruts in which our fathers trained us in their day. I do not believe these old methods are practical to day, and I know the best farmers of Vermont do not practice them. The old practice of Vermonters was to dry off their cows in the fall, say in November, and close up their business and not open it up till the next April. I think in order to be successful as agriculturists we want to be at work the year around upon our farms, and have a business that will from month to month bring in an income, and if we do not we shall fail very much in our efforts as farmers. Consequently I have practiced milking a portion of my dairy through the winter, and one can readily see the importance of having in the winter a feed, grown on our own farms, that will produce a good supply of milk, and among the feeds grown on the farm I recognize that the corn crop is one of the important ones, standing right along up with the early cut hay and clover. I believe the farmer can do a good business through the winter months without buying a great amount of feed if he will use ensilage. I do not condemn the purchase of feed for I purchase a good deal of it myself, and advise others to do so, but at the same time I believe it is important that the farmer should produce upon his

own farm all the feeds he can for his flocks and herds and secure them at such times as he can obtain the best results from them. The early cutting of hay is an important question—a question that is being studied more in our state, and more attention is being paid to it, and more of the best and foremost farmers in the state are cutting their crop, a good portion of it, in the month of June. Cows will do the best when the grass is young and sweet and tender, and the more we can do to secure the crop when it is in the state of tender grass the better will be the result.

But now to return to the subject of raising the corn crop. It has been my practice for the last eight years to take the meadow on my farm where the grass has run out more or less and turn it over in the fall of the year, and plant my corn the following spring upon the greensward. I do it for two or three reasons. I have plenty of time to do that work at that season of the year. The fall work being out of the way in November, we commence our fall plowing, turning over from fifteen to twenty acres. And the importance of thoroughly plowing the field in order to produce a good crop of any kind cannot be overestimated. A good plow is essential, and also a man to handle it who can plow the field well. In plowing it you go a long ways toward the cultivation of the crop the next spring. I plow in the fall of the year for another reason. I like to spread the manure in the winter, drawing it daily from the stable and spreading it upon the field. I tell you there is solid comfort, as I go home from week to week from these meetings and know that the field where I shall plant my corn next spring has been carefully plowed, and I can look down upon it or go over it and know that the manure has been drawn out and evenly spread. I save a large amount of time and I have more than half accomplished my spring's work on that field by doing my work in that way. As soon as the snow and rain and frost, which acts upon that soil and upon the fertility, has passed from it in the spring and the land has become dried I have an opportunity then and there to start my wheel harrow two weeks before I want to plant

corn; going over the field in that way and then letting it rest a day or two, and then I go over it again putting on the spring tooth harrow, thoroughly working and preparing the soil for a seed bed, and when this has been accomplished and we begin to drop the seed into its bed it will germinate and grow with rapidity. The average farmer of this state neglects his work by too hastily going over those fields. They do not attend to the preparation of the seed-bed as they should. A few weeks ago I heard a representative farmer of this state talking upon this subject, a man who is careful in the preparation of his soil, and has one of the best farms and best herds of cows in the state. He said that his attention had been called to this from the fact that in years gone by he was the only man in that vicinity who had a corn planter, and he would sometimes assist the neighbors in planting their corn after he had finished his own, and he told me that in a great many instances the ground was too little prepared for the kernel of corn and for the growth of the plant. And so it is, go where you will in the state, this work is left too much to the average hired man, and too little care is given to it by the farmer himself.

After I prepare my ground I plant my corn with an Eclipse corn planter, in rows about three feet apart. I drill it in, and I will admit that I usually put in too much seed. I think fifteen quarts is better than more, and yet a good many of us put in a bushel to the acre. The plant needs a good deal of sun light, and we need to grow the ear upon the stalk. We need the ear for the purpose of putting it into the silo with the stock. I believe the day is fast passing when the farmer of Vermont will husk his corn, with the exception of what is necessary for seed and to take to the mill for family use, because with my experience I find it much better to put it into the silo.

As soon as I have planted the corn I want to put on the smoothing harrow, and in a day or two, after the seed is planted, stir the ground with a light harrow. I believe it is a valuable implement to use after the corn is planted, working it until the corn is up, and then put on your weeder, doing your work large-

ly with the horses. The expense of farm labor is great and we want to avoid all this expense that we can.

In my judgment there is no better crop that we can put upon our land to seed after than the corn crop. After it has been cultivated, say along the latter part of July, we can put on our grass and clover seed and it will get a good start and be well protected from the cold blasts of winter. It is the universal experience among the farmers who have tried this plan, where we have held meetings, that they have had good results from this way of seeding and are largely in favor of it. An important thing is to plant a kind of corn that will come up to maturity in order to get the best results from fodder corn. The scientific men tell us that unless the corn comes to maturity, or if we cut it before it comes to the glazing point, or has passed the boiling stage, we loose a large part of its feeding value; and if we allow it to stand until it has become dry we lose in that way. Here is the importance of raising a kind of corn that we can get up to this point, for the best results of the corn crop are essential, as you can readily see.

I want to talk for a little while in regard to the method of harvesting this crop. The farmers in the State of Vermont have done well, in my judgment, compared with those of other sections of the country, in regard to the silo question, and from the experience I have had with it I have come to the conclusion that it is one of the important factors upon the farm. I know you can obtain better results from corn put into the silo than in any other way that I have any knowledge of. One of the great questions to the average farmer, and what has prevented a great many farmers from building silos, is the expense of building. Now we have in nearly every community in the State men of means who are farming, and those men can do as they see fit in their farm operations, for they are abundantly able, but the average farmer of the State is the man we are after; the man who has a mortgage on his farm; the man who maintains his family and educates his children, and pays all the running expenses from his farm; he is the man I want to meet

on this all important question, and if there is anything on the farm that is a mortgage lifter it is the silo. It has helped more than one man out of trouble in this State. And as I started to say, the expense of building the silo has been the great bugbear, and the first that were put in in our State were built by wealthy men, costing from $500 to a $1000 each ; and that is all right. But it deterred the average farmers from building for they saw at a glance that they could not afford such an expense ; I was among this latter class of farmers. I attended the meetings of this Board, and I have followed them up from year to year ; and I want to say, gentlemen, they are a great advantage and a great help and if the young men of our State will attend such meetings they will find the information they obtain will be of great value to them in their farm work. I am glad to say that in all the meetings this winter there have been more young men, more of the sturdy men of our Green Mountain State, who have attended. It is a fact that the attention of the farmers on the hillsides of our State is being drawn towards these meetings more and more each year. It is of importance that you improve these opportunities of gaining knowledge, for it is important that you start right at the very commencement. I attended the Dairymen's Association at Burlington in 1889, and John Gould talked of this question of silos and I listened to his remarks on the practical building of silos. I went home and went to work and got my lumber together and built a small silo to try. The lumber cost me about $36, and with the additional help I had to have, doing what I could with a man in the summer, we put up that silo at a cost of about $55. And then the question arose as to how I should fill it, whether I should cut the corn for ensilage or put it right in from the field whole. I did not have any ensilage cutter but I had a horse power and I borrowed a cutter from a neighbor, and I filled half of it with cut ensilage, and half of it with whole ensilage from the field. Since that time I have not cut any ensilage. I think more are cutting than are putting it in whole, but it adds to the expense of filling the silo if you

cut the ensilage; you cannot get as much into the silo, and in my opinion the whole ensilage is just a little bit better.

Well, from that day to this I have been milking my cows in the winter, and this summer I am going to build a larger silo. I may advocate the cutting of ensilage in the future. In building a silo, take pains to bind the corners. I put in cedar sills, and double board, putting in paper. Put in sand at the bottom to keep out the air. Perhaps it would be better to put in cement, but I have not done it. Then put in part of a load of old straw in the bottom and put the ensilage on to it. I have done this way and I have been very well satisfied with the result. I buy certain kinds of grain to balance up this feed and have built up my dairy with pretty good results.

Question: Did you build a building?

Answer: No, I divided a bay in the barn, making a silo 20 feet deep, 12 feet long and 20 feet wide.

Q: Do you put the meal onto the ensilage?

A. I feed gluten and other meals, and feed that separate.

Q. Where are you going to build the next silo?

A. Outside of the barn; and a big one.

Q. Are you going to build it round?

A. No, I think I shall build it square, though I do not object to a round silo.

Q. Is there any difficulty from ensilage freezing when the silo is built out doors?

A. No, I do not think so.

Q. Doesn't your whole ensilage ever spoil on the top and sides?

A. It spoils on top a little but there is no trouble from its spoiling on the sides. I looked into the silo recently and it was perfect.

Q. Do you wet it?

A. No sir, I don't carry water to put onto ensilage yet.

Q. Do you put anything on top?

A. No. I am not drawing in any stone.

Q. Do you lose some ensilage on the top?

A. Oh, perhaps a small load. Last year I didn't loose any. I commenced feeding the next day after I finished putting it in.

Q. How much phosphate do you use to the acre?

A. Two hundred and fifty to 300 pounds.

Q. Does ensilage hurt by freezing the corn fodder?

A. I don't let the corn freeze.

Q. How do you help it when the freeze comes when you are asleep?

A. I cut it before the freeze comes.

Q. When you put a load of corn in the silo do you keep the outside or the middle the highest?

A. I think it is best to keep the middle a little the highest.

Q. Did you ever cut corn and stook it and let it partially dry?

A. Yes, and lost ensilage by it. If you do that it will firefang.

Q. Do you think if you raise the big corn it will spoil if you put it in whole?

A. Well, I have not had a chance to try it yet.

Q. Do you cut your corn crop with machinery?

A. No, I think it is not as well to put it in bound. I would not recommend that because I do not know.

Q. How about its rotting?

A. You are not going to get much rotten ensilage.

Q. How are you going to keep the rats out of that silo?

A. Keep three good cats and they will keep the rats out.

Q. Do you keep the angora cats?

A. No, I have not yet tried that breed.

Q. Do you get that ensilage out yourself?

A. I let the hired man do that. There is no great trouble in getting that ensilage out if you commence where you left off putting it in.

Q. Is it ever inconvenient in the manger, that is, don't the cattle ever throw it out?

A. No, they are not going to throw it out; they go for it and eat it.

Q. How about that if it is this fifteen foot high kind that you spoke about?

A. There are not many raising that kind. In regard to this Southern white corn, I do not think it is profitable to try to raise that.

Q. Do you feed any hay while feeding your ensilage?

A. Oh yes, I feed hay, yes, and grain and oats and ensilage.

Q. How many times a day do you feed?

A. Four.

Q. Do you ever get bad results to the milk on account of feeding ensilage?

A. No, nor anybody else if they put the ensilage through the cow.

## SMALL FRUIT ON A DAIRY FARM.

BY F. A. CONVERSE, Woodville, N. Y.

*Mr. Chairman, Ladies and Gentlemen:* You have noticed by the programme that I was to talk on small fruits upon a dairy farm. Lest there might be misgivings in the minds of some one, my talk is upon berries. We realize the necessity of having one more crop on the farm, and that is fruit.

I think I will digress a little from the subject, and speak of the fertility of the soil and the keeping up of the products of the farm, and getting more money for them. Every farmer should have more than one string to his bow, and not depend upon one crop. The fellow who gets let down on some one crop, who has four or five other sources of revenue is the man in the main who gets the most out of his farm. Another thing I have observed, is, that the man who is trying to make two blades of grass grow where one was wont to grow, is doing well. I am of the opinion that if a man would cut a four hundred acre farm right in two in the middle he would get more out of it by putting his time on the one-half of it. There are so many problems which require consideration at our hands that it is only the student, working along those lines, who is making anything. An acre of land will carry an animal. Since the advent of the silo it is possible for a man, on tillable land, to carry an animal on every acre. I haven't any sympathy with the man who goes into the market and buys nitrogen. He can produce it on his own farm. In order to do that, we want a short rotation of crops. I do not believe, when we have so many noxious weeds, a man can afford to do that. We want a short crop of corn, clover and grain, cutting off all crops of clover and turning it over immediately. Spread the manure directly on the sod and then turn that over

and raise grain. With us we have about ninety-five days in the corn season, and I believe a man who can raise big corn cannot afford to fuss with small varieties, because it is just as good, pound for pound. The man who has not got a silo is a back number.

We should strive in the future to produce everything that comes from the farm more cheaply than we have done in the past. In running a farm in this way we find that, not only have we got to give it extra tillage, but we find that we can produce the hay, the ensilage and the berries and potatoes much cheaper than we did in the old way of cropping it in the same manner year after year with the same crop.

We want to cut the hay early. If we do not have our haying done by the first of July we think we are behind times. That gives a chance to cut the second crop and get all the clover and hay needed. If we are going to increase the nitrogen we must raise clover. Nitrogen produced in this way is cheaper than it is when bought.

Our cows are fed on soiling crops right through the season. That is, every day when in the pasture they are fed in the stable. We find it cheaper than to have so many acres for the cow to go over. She only has about three quarters of an acre. Corn should never be used until it is matured. In planting we use only ten quarts of seed to the acre. The man who uses a bushel is getting ninety-five per cent. water and five per cent. feeding quality, and the cow can eat that all day and bleat all night.

This year we are making a success of raising alfalfa, and instituting other grains to be used until the corn crop is ready.

We have adopted the methods, spoken of this morning, in regard to using machinery. Hand labor is a thing of the past, and with horses only twenty dollars a dozen and machinery as cheap as we can get it now, it is not worth while to spend time doing work by hand. Some men think they must hill up the corn, but they violate the law of the growth of the corn by hilling it up. We believe God gave us weeds that we might stir the land and improve our crops while killing the weeds.

We have been enabled, year by year, to bring up the old broad acres by bringing in nitrogen by the use of clover and raising small fruits and other crops that I have already mentioned. I believe it is possible to maintain the fertility by keeping stock, instead of going into the markets and buying it.

We hear a good deal in these days about the average farmer. Over in New York State the average farmer does not amount to much. I believe we must bring up the average man to a higher standard.

I started out five years ago thinking that if it was possible to make $100 from an acre of berries, I could make $1,000 from ten acres. But I "bit off more than I could chew," as the boys say. You want to start in in a very small way and study the market you are going to cater to. That is a good rule for everything you are going to produce on the farm. One of the secrets is to raise what is wanted, and they will have it, and it will pay to raise it. We never ought to plow in fresh manure under a small fruit crop. It is all important, however, that we manure the soil rightly; and our way is to keep the cows in the stable every night and take the manure and put it into a compost heap, and use that. We manure the corn and potatoes, and the following year we set strawberries on the land, where we have kept every weed down. I believe the time to kill a weed is just before it starts, and the cheapest cultivation we can have is to kill the weed just before it starts. We till the corn and potatoes thoroughly, and when we come to set out the berries we know the land is in perfect condition. Tillage is manure for this reason, that by bringing in closer contact the particles of soil we increase the climatic action in that soil and the more plant food will be made valuable, and hence tillage is manure, and that is what we try to do. This subject of giving the soil a sufficient amount of fertility reminds me of the old lady's receipt for sugaring a rhubarb pie. She said she gave it all the sugar the receipt called for, and all her conscience would allow, and then turned around and put in another handful. And that is about the way we manure for berries.

My home is twenty miles south of Watertown on Lake Ontario, and the conditions are about the same as you have them here. We are a little late in getting onto the market, and the other fellows are out of the way, which is an advantage that you have here. Berries will grow anywhere you can raise good corn and potatoes. There are varieties that will not grow except on clay soil and heavy land. I do not take a great deal of stock in those gentlemen who run around the country representing nurseries, telling what nice trees they have got. You and I can make up our minds as to the varieties we want and order them at less cost, or, better still, get them of our neighbors and get plants that are acclimated and grown in conditions nearly like our own. In setting strawberries, take them from the parent bed and set them just as early as possible after you take them from the bed, and just as soon as possible in the spring. Our practice is to take them out with a fork and trim them to two leaves and cut off the blossoms and buds and all but two roots. We know that the feeding roots of all trees die every year. By pruning thus you find that these feeding roots come out every season and support the plant, therefore we cut the strawberry plants so the roots are about four inches long. In setting them, use a common hoe blade after having straightened the shank, and put it down lengthwise of the row and set the plant so that the roots are fan shaped in the ground. First, because we are going to hoe with a Breed's weeder and not by hand. Second, they root down to moisture and will not dry. Grow the plants under the row system instead of the hill system. If you do not have too many plants to start with you can grow as many in the row as in the hill. The reason why we do not get the yield we ought to is because the plant is not properly pollenized. In setting them they should be set three rows of the pistilate varieties and one row of staminate varieties. If we are to grow large fruit, and that is what our aim should be instead of growing small fruit, we should never allow more than four or five runners to start from one parent plant. As soon as the plants are set, or in four or five days, you can go over the

ground with a Breed's weeder. You can hoe the plants and cultivate the entire surface of the ground with this weeder cheaper than you can do it any other way. When the runners get so large that they begin to root then you must put the cultivator in the row. We cultivate that ground the entire season until it freezes up. A great many men think they lose the use of the ground the first year, and hence it is extravagant to raise that crop. I have tried to raise other crops between rows, but not with good results. If you do it at all you want to wait until after the fruit is picked, and then put on some quick growing crop. If you put on this extra crop earlier you retard the growth of the plant and hinder the ripening of the fruit. When cultivating you do not want to whip the runners around one way one time and the other way the next time you go through the rows, but go so as to keep the runners growing the same way all the time.

When the cultivating is done in the fall, in order to put the plants in the best condition to live through the winter, it is necessary to mulch the berries. We get marsh grass from the lake and put on two or three inches. If we want to cultivate that soil the next spring we rake it off with a horse-rake, but if we do not want to cultivate we leave it between the rows, and if the berries are liable to get dirty we leave the mulch to protect the plants. As time goes on we have got to take more pains than we have done heretofore to hold the moisture in the soil. The more we cultivate land the more moisture we are going to loose. If it is necessary to fertilize land with the commercial fertilizer, and it generally is because we believe a man can fertilize one acre and get more out of it than he can out of three acres in the usual way of fertilizing, we should study to get the best results in the most economical way. We have been in the habit of purchasing raw materials, raw chemicals. On this question of fertilizing our crops we have oftentimes made mistakes. It has been quite commonly the practice to put fertilizer on the corn, berries, oats, potatoes and apples; on the hill land and low land; in short that has

been the one balm for all the ills the land is heir to. We have not usually waited to consider that on that fertilizer there should be a formula for the crop we want to grow. By having such formulas for the different crops you will get better results. For strawberries you want a plant food so proportioned that it will be just exactly what the plant needs. For cane berries the proportion would be a little different, because we find they do not need quite as much phosphoric acid. The time to fertilize these berries is about the time of putting the Breed's weeder through, and then scatter a little on to the row; or wait until the next spring and put it on at about sugar season. The fertilizer will never burn the foliage if you have the right proportion. We take the precaution to put on the great bulk of the fertilizer at that season rather than when the crop is growing.

So much for fertilizing berries. We start out with our berries in putting out some black-caps. We used to think we should put them in rows seven feet apart, and three or four feet apart in the rows, and cultivate both ways. When down in Poughkeepsie I found men there growing berries and I observed that they kept the ends of the new growth pinched back and let them start out laterals, and they also kept those pinched back, and in this way they had a little hedge row. In this way they can cultivate the land and berries to a better advantage. In setting the cane berry plants we take a piece of land and go through it with the plow and plow it very deeply and let the land fall back. We set the plants on the land side of the furrow and then go back through with the plow and that will pack the soil against the stalk. The little shoots will come up the first year about a foot high and we pinch the tops off. After you have kept these plants back it is necessary to keep the cultivator going every single week in order to keep the soil properly stirred and the weeds killed, and after a little time you will have the ground so shaded in that row that the weeds cannot grow.

After the black-caps are off then the red raspberries are ready for the market. We treat the red berries the same as we do the blackcaps, trimming down the branches until instead of

three feet wide, as we used to allow them to grow, the row will not be over eighteen inches wide. You will get more berries in this way. The Shaffer is a variety that will grow more berries than some of the others but people do not like its looks as well for the color is purple; but you can afford to sell them at two cents a quart less. They are harder and will stand up better. So far as our location is concerned, and our access to market, we are seven miles from the cars and twenty miles from the city of Watertown, where most of the berries go, and this matter of standing up is of great importance.

The berries we get the most money from are the long blackberries. We are able to cultivate blackberries and can get them onto the market in about two weeks before the common berry crop comes in, so that we do not feel the effect of the cheap berries that come in from the mountains. The kinds we raise are the Snyder and Taylor. The Snyder is not quite as good, although earlier, for if it is left in the sun it turns red. The people like a large, lustrous black berry, and the seeds of the Snyder will turn red by exposure. I had been selling berries for six, seven, eight, and possibly ten cents a quart, when I had occasion to go down to the fair in Oswego County, and there I found twenty-five varieties of blackberries on exhibit; and there were parties there who were getting $600 per acre for their crop. I found an association there of about one hundred men, and six or eight of them were averaging that for their crop. I talked with several commission men and they told me that, particularly in New York, they never had seen the markets overdone in any way, or satisfied with that kind of berries. I talked with those men who seemed to be getting the most for their berries, hoping to come back home and put out those berries myself and change the profits, and get more money out of it. Last year I got some of the plants, and this year I hope to be able to cater to this New York market. I found that those men who were putting as high as a ton of fertilizer to the acre were getting the best results.

The people in town are tired of being imposed upon by a poor quality of fruit. I believe what we want to do is always to put out our farm products in such a way that we can put on to the package our names, and those names are a guarantee for the quality of the goods every time. That is what those people there are doing.

I have had some experience in storing berries, but I do not believe that pays. The more you handle berry fruit after it is picked, the worse will be its condition when it comes onto the market.

We live near a village, and in that village you can get all the pickers you want. Every year we have to turn pickers away. They will work there if they cannot get more than half the price for picking berries that they can for some other kinds of work. We have little baskets that hold six quarts, and they will pick those six quart baskets of berries, every one of them more than full, and bring them up to a little berry shanty in the middle of the field and here they are looked over without turning them out. In packing them we aim to have the top row look as well as possible, and have them uniform all the way through. If you are putting up for market more than one kind of berries you should have one kind in one crate and one in another, and you will get more for them than to mix them. Another thing we aim to do is to give people full measure. We have a basket that will hold a full quart and we fill it so they will get an even basket for their money every time.

Last year we began to spray. This I regard simply as a matter of insurance. Three or four plantations near us show evidence of disease, and I am going to keep that disease off by spraying if possible. I am going to keep on spraying and if the time comes when those fellows go down by reason of disease we will be in the best possible condition to supply the increased demand. There is one fellow who has already had to plow up three acres of cane berries on account of disease. We think that can be prevented by spraying.

I would like to say just a word to the ladies in the line of helping them out on garden fruit. It is a sad fact that most of the people in this country are not getting enough to eat. If I were to ask how many are raising what fruit they need on their tables, I would get but a few answers. There is no excuse for a man not having all the fruit he needs for his own use from the time strawberries begin until the apples are picked. You people do not know anything about what a good living is until you have had all the fruit you can eat. The way to eat strawberries is to have them for breakfast, dinner and supper. If you can get the men to provide you with a small piece of ground I will send you plants enough to start a strawberry patch.

Q. What is the best time of year to set out strawberries?

A. Just as early as you can in the spring.

Q. If you were going to use muriate of potash on strawberries, when would you use it?

A. On the snow late in the spring.

Q. Are we to understand from what you said that you never hill potatoes?

A. Yes, sir.

Q. How do you keep them from burning?

A. We use level culture and put them down five inches. It violates the law of the potato to hill them, and by treating them in this way you save moisture.

Q. Does the white grub trouble your strawberries?

A. No, sir. You will never have any trouble from them if you use ground that has had two hoed crops preceding the strawberries.

Q. Have you tried irrigating?

A. Yes, sir; for two years I have had a tank rigged on a wagon and during the dry season I have kept the boy at work with that, and I think every day's work brought me perhaps $25 worth of strawberries. Lately I have not done that. I have retained the moisture by mulching.

Q. Do you cultivate deep to hold the moisture?

A. No, sir, shallow.

Q. What is your soil?

A. Clay loam. If you commence irrigating you must keep on with it.

Q. How many bushels of potatoes do you usually get from an acre?

A. About two hundred.

Q. Do you dig them with a machine?

A. Yes, sir.

## THE CONTRIBUTIONS OF SCIENCE TO PRACTICAL AGRICULTURE.

By M. H. Buckham, Pres. U. V. M.

I have been reminded to-day of an anecdote which I heard just before our civil war began. It is said that a certain man, who had been very prominent in temperance matters, wrote to a gentleman suggesting something about a temperance meeting. The gentleman to whom he wrote was very full of the war spirit, which was just coming on, and said, you talk to me about temperance, but I am so hot on the war matter that the thought of cold water makes me siss.

I do not know how you have been here to-day, but we, in Burlington, have been filled with war and rumors of war, and when I try to talk I have got to clear my brain a little of that thought before I can talk. When the paper came out in the morning it looked rather scarey, and I noticed my class in college this morning was restless and I could not hold their attention as well as I usually can. I did not know what was in the air, but something made them restless. As soon as class closed I heard talking about an extra edition of the Free Press, and I found out such had been published and that it was very sensational. It looked as though war was coming, and every talk has been of the coming war. I hope you have not had the scare here. So, to quiet my own mind, I have said certain things to myself, and to others with whom I have conversed. I am not a prophet and cannot say that war will not come in time, however I hope it will not, and believe it will not, but if the worst we can imagine in connection with this matter is true, it does not necessarily mean war. We will suppose a foreign vessel, lying in New York harbor, should be blown up by some cause, should

that be a cause for the country to which that vessel belonged to go to war with us? Certainly not. We should pay an indemnity, not only large enough to make good the damage to the vessel, but also to make some sort of recompense to the families suffering loss. If we have suffered in such a manner in the harbor of Havana we have a right to demand a recompense. If granted, that would be well. If our demand should be refused, it might not then necessarily produce war.

My class asked, what is our preparation for war. So I looked up the matter a little. Every body knows, as a naval power, we are not a first rate power. We have never contemplated naval defence with any force. The Spanish navy, unfortunately, is more than double ours in number, and probably double ours in weight. We have one fort defender; six cruisers; six second class and twenty or thirty third class cruisers and sixteen torpedo vessels. We are not in condition to cope with Spain in that condition. Spain is in no condition to fight with us, because she is bankrupt. A war is an expensive thing. Our war cost $2,000,000 a day. This war in Cuba alone has cost four hundred million dollars. Our national debt, aside from that, is several millions. Both parties want peace, and both will, probably exhaust every means to secure peace.

Now with reference to the contribution of science connected with agriculture. I suppose when a man comes from a college to address an audience of farmers, and comes in the name of science, very naturally the farmers look at him with the corners of their eyes, and say, I wonder what he will know about it? Farming is not a matter of science, it is hard, backaching work, early and late; it is cleaning out stables and milking cows, and plowing and harvesting. It is not the science you carry on in laboratories; and I do not know but what scientific men are to blame. It has been partly a fact, though not so much a fact as it used to be. However, I think farmers are coming to think science is of value to them.

When I was thinking what I should say to-night, I thought I would first find out what science is. I went

to Webster's Dictionary to see if I could find there a a definition that would be satisfactory. This is what it is: "Knowledge, penetrating and comprehensive information, skill, expertness; the comprehension and understanding of truths and facts; investigation of truth for its own sake; pursuit of pure knowledge; that which is known," etc. Now is that very enlightening? Have you any clearer idea of science than before I read that? What is science? Science is nothing but knowledge of things as they really are. That is all there is about it. Science is knowledge of things as they really are, not as somebody, in ignorance, has supposed them to be and merely taken a superficial view of them; not as somebody has guessed they are without verifying his guess. Science is knowledge of things as they really are. Sometimes we talk of scientific facts. All facts are scientific if correct, if according to things that are really so. Sometimes we talk about men of science. All men are men of science so far as they know things that are really so. A man of science may be a doctor or he may be a clergyman. The subject upon which he exercises his mind may be natural law or civil law. If anybody knows things as they really are he has some science.

You have got to know things in three dimensions. You have got to have sources of facts in certain directions along these lines. To get at the facts concerning a certain thing one has got to have sources of intelligence along that line. That is the linear method. He has got to know his subject. If he knows only along that line and does not know to the right and left of that line then he does not know the things within that line. You have got to know things broader, and know things deeper! You have got to have length, and got to have breadth, and got to have depth, and you have got to go to the bottom. To know things as they are you have got to go below the surface. When you come to learn science you have got to know things; to know agriculture, as they really say. There are three stages in learning things as they really are. First, we have got to know what we want to find out. Suppose it is how to get

cheaper nitrogen ; suppose it is to find out what is the cause of the potato rot. We have got to have the problem, to know definitely what we want to find out. It has come to be one feature, to find out what it is we want to know. It is only a question of time when we shall be sure to know that. We see that illustrated in the case of Edison. Such and such a thing is desired, and to get at certain things we must do this. It is perfectly certain that any of the things of life, the things that are desirable, will be finally sooner or later found out. First, we have got to have the problem. Second, we have got to have theory. Most people think they are very wise when they run down theory. No discoveries have been made except by mere accident, and never will be made unless preceded by theory. A man sees in the distance and then he guesses farther than he sees. If his guess is a good one his experiment will prove it. If his guess is an incorrect one his experiment, his observation, will be scattered and he takes another. I alluded a moment ago to the problem of the potato rot. There were a dozen guesses before men got the right one. When you older men were young you can remember some of the guesses made as to the cause of potato rot, and one after another had to be abandoned, and finally we went on the microscopic test and when we got astride this germ theory, and began to read it thoroughly, we found out what the trouble was and that proved to be true.

Now to make an application of this to agriculture. The first recollection I have, of any importance, in regard to its application to agriculture, was what used to be called fancy farming, or fancy farmers, and I do not suppose that term was introduced by those who occupied their time in this class of farming, but put upon it by those who were not trying it. I am thoroughly convinced that the farming interest has been greatly indebted to what was called fancy farming, although it did not proceed on scientific lines. It was more experimental without science. The fact that so many of our breeds of cattle have borne the name of noblemen, is evidence of this fancy farm-

ing. We have a duke this, an earl that, a lord this and a lord that, as the names of great sires of herds, and that fact alone shows what was done by that class of men in fancy farming.

The next of importance that I knew anything about, was what is known as scientific farming in Scotland. A young man who was going to be steward of a great estate was sent to live, when a boy, with a man who was called one of those scientific farmers. I suppose some of the finest farmers in the world are the farmers in the southern counties of Scotland ; and their boys used to go and be trained in scientific agriculture, to become managers of great estates.

Somewhere in the early part, or first quarter, of this century, chemistry began to take hold of the great problem of agriculture, and especially the German chemistry, and the first idea they got hold of was chemistry of the soil. That seems to be the first information of scientific agriculture that they took hold of. The great necessity of the crops was due to different conditions of the soil and by chemical analysis, and study of the soil, they could adjust crops to the soil, and perhaps alter the construction of the soil by chemical agents. Out of that idea has grown this great contribution to practical farming, artificial fertilizing. I can remember when there was not a ton of artificial fertilizer in the State of Vermont. I mean by artificial fertilizers, those made up of that chemical composition adapted to agricultural products. I can remember when there were no mowing machines. They said mowing machines would not cut clean ; that they would kill the horses ; that they would have to take them to a distance to get repairs. War came on and farm hands became scarce, and consequently the mowing machine came on, and many other important machines, as well, such as plows, harrows and harvesting machines. There is no more beautiful study in the world than the study of draft to the curve of the plow. It is a very nice calculation which gives you the modern plow.

And then this germ theory, which is making such important contributions to many of the sciences, especially the science of medicine. I can remember when that practice came into vogue.

A good physician, Dr. Thayer, a representative of the old school physicians, and Dr. Goldsmith, of Rutland, had a famous dispute, in Burlington, concerning the germ theory as applied to typhoid fever. Dr. Thayer strongly maintained that there was no such germ as the typhoid germ, but that it was a filth disease. Dr. Goldsmith had been abroad and spent thousands of dollars in making thousands of investigations, and stood up for the germ theory, and Dr. Thayer stood up against the germ theory. Now what progress that theory has made. The theory of germs has come to be felt. We caught this typhoid germ and we cultivated it. We do not know all about him but we do know a good deal about him; also the germ theory as applied to cattle diseases. I want to pay the farmers a compliment. So far as my knowledge goes, as compared with farmers in other States, they have shown a remarkable degree of intelligence and progressiveness in the way in which they have accepted the teachings of agricultural science with reference to tuberculosis and tuberculous diseases. Naturally farmers rebelled. They would not sacrifice their herds. One man said, if they came around he would have a shot gun and dispense with that kind of test at his place; but gradually the farmers have come to see the value of this knowledge as it applies to their industry. The men who have resisted it are the doctors and business men, such as we have in Burlington, and I presume we have them all over the State.

When I found I was to be asked to give some scientific contributions to agriculture, I went to Prof. Hills and asked him to jot down something I could use, and he give me twelve topics, which have utterly confused me. I could not go over them in all night. I want to say to you, however, that the contributions of science to practical agriculture are in two directions. First, they have supplied the farmer with a large amount of most valuable knowledge. They have made valuable farmers; they have made valuable to the farmer a large amount of valuable knowledge; so that the business of farming is no longer a business in which he can succeed without availing him-

self of the best available knowledge. It used to be said that if you could not do anything else with a boy, put him to farming, but now it has come to that that the brightest boy wants to be the farmer, and he then will not know enough. He has got to be a student; he has got to be a thinker, and he has got to be an observer. There is a vast amount which this valuable science has brought to your door.

The second point is one on which I want to say a word or two. These contributions, practical to agriculture, have so transformed the business of agriculture that it has now become a great competition of systems of industry. A man cannot buy a little piece of land and sit down and bring up his children and support his church and schools with no reference to the world outside. The farmer has gone and indirectly brought the great world of industry, which embraces men of all professions, to wait upon him. I mean by that, that the farmer in the town of Morristown has to compete with the farmer in Iowa. The farmer in Argentine Republic has to compete with the farmer in Egypt, and the farmer on the Black Sea; all knit together in this great agricultural system. We used to say a farmer was an independent man. He is no longer an independent man. He has got to hustle. He cannot sleep and let things go by him. He has got to be on the alert. He has got to know the laws of nature in his business. If there is a new way of making butter and cheese he has to know it here in Vermont because we have competitors on the North and South and West, and all over the world, so far as farmers go. All these improvements and all these inventions are the results of science. Science has helped to bring about this condition. As has been said here this evening, and I have no doubt has many times been said in your meetings, education has a bearing upon this matter.

The New England farmer has always been a man of intelligence, but in the future he has got to be more intelligent and know more about the things which he uses about his profession. It will not do for him to use any old methods and keep

up old prejudices. It will not do for him to sit down and say, the ways that were good enough for my father are good enough for me. One man down in Bennington County, when agricultural meetings were being held there, said he would not attend a meeting of farmers, because if he did he would have to change his methods of farming. I hope that is so. We are obliged to change and improve if we want to keep up with the times, and that applies quite as much to methods of farming as to other pursuits. It does not necessarily mean a radical change, but simply to keep up with the new things that are coming on.

I do not suppose agriculture is going to be an industry in which large profits can be easily made. Science cannot accomplish that; but it is an industry in which hard work and long hours will bring a good compensation in every case, in a quiet and rational, sober and moral life. And the opportunity for culture, especially during our long winter evenings; the opportunities for society, I am glad to say, our friends are making more of. One drawback in farm life is the solitude. I heard a very pathetic story told by one of those good missionary women who go about the country for the purpose of doing good. Those women get inside of homes and get the secrets of homes where the men could not, and they tell us that sometimes the quiet and solitude and loneliness of the farm home is very sad, and that the men do not do their part in remedying this. They go to town and get the news, but they do not come home and tell their wives and daughters the things that bring in a little of the social element of the home. Now our lyceums, the Grange meetings, and sewing circles, and all these things, are doing something to relieve this loneliness, but we want to do much more. We want to do what we can to improve the social life of the farmer and make it more attractive.

I am a little off my track. The farmer should be on the alert to try everything that has been tried and found to be good. The farmer cannot afford to be the experimenter, but when other people have experimented and it is perfectly plain what the farmer should do, then I say the farmer, if he is going to

keep up with the times, should have his heart and hand ready to take on these new ideas and new methods and improve by them. I heartily agree with what has already been said here this evening about the possibilities of the farm life in Vermont. I do not agree with those who think that the time of comfortable, profitable farming has gone by. It cannot and never will go by, because all the world must depend upon farming. But the industry must not be lagging behind. It must be on the alert and improve by the new, tried methods, that are from time to time coming to our knowledge, and then the profit of agriculture is assured. (Applause.)

## DAIRY FARMING.

By George L. Clemence, Southbridge, Mass.

It is not my purpose to lay down to you any definite rules for managing a dairy farm, but to give you some of my own experiences.

The paper I propose reading to you this morning has for its theme the practical management of a dairy farm.

My treatment of the subject will be the relating of my own experiences as a farmer having for my speciality, if such it may be called, for more than twenty years, the production of milk, to be sold entire and at retail.

But the care and feeding of the dairy cow whether her milk is to be sold as such or in the form of butter, are so intimately allied that a system adopted for one will answer for the other. Especially will this rule apply in Massachusetts, where the law requires that the milk offered for sale shall contain thirteen per cent solids.

Whether such a law is just or unjust is not for me to say or consider at this time but as there is a law which requires that the milk we offer for sale must be of a specified standard there is nothing for us to do but abide by it. Yet it is of interest to note that the very existence of this law illustrates one of the most distinct and pronounced phases of modern farming, which is, we cannot secure quantity to the sacrifice of quality.

The enactment of the law shows also that the purchasing public knows that milk is of varying quality and demands that the milk it buys must not be below a certain standard in the measurement of its chemical constituents.

The butter maker will seek to attain not only the greatest amount of milk, but that of the highest quality, from self-inter-

est, and we milk-men must produce milk of a certain named quality for the statute law requires it.

The aim then is to get a maximum amount of milk of a required quality, from each and every cow we may own.

The problem is one of the greatest, it seems to me, that man in any calling, has been called upon to consider and solve.

All our means and energies, in every day, week and month of the year, must be directed to the end of producing milk, at a cost which will enable us to dispose of it at a profit.

As the manufacturer studies and plans with a view of finding some way whereby he can lessen the cost of the particular product of his plant, so must the farmer be ever at work seeking some means of getting a maximum amount of milk at a minimum cost from that wonderful living machine, the dairy cow.

When I consider this proposition and all it comprehends, I realize more fully than ever before that farming is a great business and that I for one know but little about it.

The material world in these present times is one of almost continuous change.

The machinery invented scarcely more than ten years ago for a lumber, iron, cotton or woolen mill, is absolutely out of date, and cannot be run profitably to-day, and the manufacturer to be successful must replace it with that of more recent invention.

In practically every business, competition is keen, and there is constant effort made to lessen the cost of production or else to increase the productive capacity of machinery without a corresponding increase in the cost of production.

What is true of other interests, as regards competition and the need of new methods, new machinery, and above all new ideas, is as true of farming, in fact if not in degree.

As the manufacturer seeks to-day to produce a yard and a half of cotton cloth at the former cost of one yard, without impairment of quality, so must the farmer who seeks the greatest financial success in his business, try to make a quart and a pint of milk at the former price of one quart.

As time goes on and with it the development of our country, with the means of intercommunication and transportation so abundant and cheap, the conditions of Massachusetts farming become more and more exacting.

Yet in this respect we can console ourselves with the thought that we are no worse off than are other interests.

So it would seem that the sensible way is to look the matter square in the face, meet the issue, and strive to hold our own.

We have long since seen a successful competition take away from New England the cattle grazing or beef growing branches of farming but when this was done for a certainty, New England had become a commercial and industrial community and there was a market for a diversified husbandry with milk and butter as the principle farm staples sought for.

When grazing was the principal feature and mainstay, one might say, of New England agriculture, the methods of farming were wholly different from those which the dairyman of to day accepts.

In the earlier time the cattle roamed over the newer and richer pastures bringing wealth to their owners by increase of growth and weight.

In the winter season the cattle were stabled and fed and if they held their own through the winter months their owners were quite satisfied.

True, many of the farmers made butter and cheese in these earlier times, going to some distant market twice a year with their product, but, as a rule, a cow's milk and butter capacity was secondary to her beef marketing qualities. Her breeding was always upon these lines for the simple reason that therein lay the main source of the farmers' income. With the disappearance of cattle grazing and general stock raising in New England because of Western competition, there came to the farmers of this section various other opportunities for a continuance of their farm operations.

The acceptance of these new opportunities caused solely by the coming of a non-agricultural population, involved the adop-

tion of methods and systems of farming differing, in the main, quite radically from those incident to the earlier class of farming.

Cattle raising for beef as the primary object, found its successful solution in the possession of extensive acres and the measure of one's financial success could be foretold, without doubt, by the number of acres there were for grazing.

Under the new system, experience shows the policy of an intensive agriculture, as compared with an extensive agriculture to be the wiser one to pursue.

Statistics show that in Massachusetts less than a ton of hay is the average yield per acre, yet there are instances of yields of three, four and even six tons to the acre. Such unusual harvests show the possibilities of Massachusetts farming, and that we, as a class, are but on the threshold of realizing all that is possible from our farms.

Again, the average daily yield of milk per cow for a year is only five quarts, while individual instances of yields of seven and eight quarts of standard milk are often reported.

As farmers we want to strive to increase the average production of our fields and the average milk yield of our cows.

It seems to me that herein lie the fundamental principles of a successful husbandry, assuming for the hour that we are engaged in the business to make all the money we can out of it.

Concentration of effort and of means, is called for, as never before in farming. The utilization of the forces of nature, the invention and adoption of machinery, have revolutionized the whole business world and farming along with the rest. The old ways of the world must be discarded and the new ones adopted if we would meet with success.

Chemistry teaches the farmer the kind and quantity of food the various plants require for their development, and this knowledge is one of the most significant phases of modern farming as distinguished from that of earlier times.

The practical value of the so-called commercial fertilizer and of chemicals is becoming daily more apparent and I believe

the time is not far distant when the average farmer will be sufficiently conversant with the chemical constituents of the different crops to enable him to know just the kind and quantity of chemicals he needs for the growing of any of them.

I also believe that it will be possible ere long to procure the chemicals we most use at lower prices than those which now prevail.

As the so-called forage crops, speaking in general terms, have practical value only as they are converted into human food by the dairy cow, their growing is the ground principle of dairy farming. They constitute the foundation upon which the superstructure is built and upon which all else rests.

In nature we find a variety of foods upon which, if in proper condition, cattle can subsist.

The practical values of these different forage crops differ with the seasons of the year and the state they are in when fed to cattle.

The growing grass of one field may be of greater worth than that of another for the reason that there is a greater amount of the elements of nutrition in the one than there is in the other.

The hay from the acre of land that has produced two tons is, on general principles, better than is the hay from the acre that has yielded only three-fourths of a ton because the first has had more to feed upon and more to make richer food than has the second.

Impoverished land will produce impoverished hay and impoverished hay or feed of any kind cannot be fed with satisfactory results.

Here, then, is one of the great trnths in farming and its recognition and acceptance will be an important step taken toward making farming a success.

The next step to be taken is to learn just how to apply this truth or principle that we may reap all possible benefit from it.

It would seem that the only way to determine this is by the experience of each other and by comparison.

Many of us are pursuing somewhat different methods to gain

the same point because there is yet no absolute rule or direction for making the farm pay best.

For this purpose I came here on this occasion to tell you of my plans, systems and experiences for making my own farm operations a financial success. I am here to compare notes, to talk over the work of the past and the plans for the future with the hope that mutual good may result.

As I have already intimated, the predominating influences of up-to-date dairy farming, are concentration of effort, the utilization, to the fullest extent practicable, of mechanical aids, the application of that knowledge of plant growth and the treatment of soils which chemistry teaches us and the proper care of the dairy cow.

Higher culture of the lesser number of acres rather than the possession of the greater number of acres is the difference between the farming of to-day and that of former times.

But how shall we make two blades of grass grow where only one grew before and how shall we manage to increase the production of milk and make a quart of milk at less expense than formerly.

These are problems of the farming of to-day. To solve them has been a study with me for the last twenty-three years, and the lines I have followed in the hope of their solution have brought me a fair success.

My farm proper is one first owned and tilled by my grandfather.

After his death my father received it as his inheritance but while occupying the homestead he pursued another vocation leaving the active work of the farm for others to do.

The farm is at the summit of a hill and distant one mile from two villages having at present a combined population of 8,240. The farm contains about forty acres of tillable land and sufficient nearby and out lying pastures with woodland to make a total of 165 acres.

I assumed the active management of the farm when I was twenty-one. It was then stocked with eight cows, four head of young stock, one horse.

To-day the same number of acres are carrying all told thirty-two head of cattle, four horses, and the average daily production of milk is two hundred quarts, or, in other words there are five quarts now where there was but one twenty-three years ago.

Besides the five-fold increase in the milk yield of my farm, it has various specialties, one of which, cabbage growing, engages three acres, the product of which the past season was 25,000 heads.

When I began farming on my own account, butter making was the object but I soon changed this to the selling of milk upon a route I established and this has been maintained to this day.

One of my first plans adopted to the end of larger and better crops from my acres was clean culture, by which I mean the destruction of weeds.

For several seasons the labor expense for the care of my so-called hoed crops had a discouraging look because it was so large, but I kept at it and the results have long since justified the expenditure of labor and money in those early years for the destruction of weeds upon my farm.

No farmer can afford to let weeds occupy a portion of the land he has ploughed and fertilized.

A growing weed is an expense and constant drain, small perhaps in an individual instance, but when ten thousand of them are sapping the land of its fertility, it means a less quantity of corn in the crib when the harvest is ended.

Let me repeat here by way of emphasis that an annihilation of weeds upon one's farm is of the wisest and best paying kind of farming.

Continue this fight against weeds for two or three seasons and you will be surprised at your success in eradicating them.

But perhaps the farmers of this section do not need this advice.

I early turned my attention to fertilizers, not alone to amounts, but to their nature, for the science of chemistry which

has done so much for agriculture, shows that certain plants need certain and distinct properties for their best development.

Fertilizers, their nature and method of application are among the first principles of a successful agriculture. To increase and maintain the fertility of his farm must be the constant aim of the dairy farmer.

The utmost economy should be exercised in the care and saving of all stable manures and all possible sources of these made the most of.

As influences are constantly at work to cause a deterioration in the value of farm supplies of fertilizers these damaging influences should be guarded against, as a dollar saved by maintaining the strength of fertilizers is as good as a dollar earned or gained in any other way.

If you desire and have opportunity to buy stable manure learn as near as possible the quality of such manure, for while it may be worth four dollars a cord, other quantities might not be worth half that amount.

While considering the matter of fertilizers let me say, in parentheses as it were, that their purchase would seem to offer a fine opportunity for co-operative buying.

Personally I believe that the scheme of co-operative buying can be made an advantage to any community of farmers.

The use of ground bone on my farm, has been for every crop, practically, and in every instance its use has been of the most satisfactory character.

My plant for the preparation of ground bone consists of boiler, a ten horse power engine, a vat for steaming the bones, grinding machines, racks and bins for drying and other requesites essential for the work. The mill is a frame building, 16 by 32 feet in dimensions. The machinery is in the basement, while on the first floor proper are stored the bones as I buy them of the soap peddlers and others. The attic floor is used for general storage purposes.

The bones I grind in the winter when farm work is not so pressing as it is at other seasons. The capacity of the steaming

vat is 1500 pounds and it takes an average of six hours to sufficiently soften the bones to be ground.

My engine and boiler are combined, are portable and used also for furnishing the power to saw wood and operate an ensilage cutter.

The average cost to me of a ton of ground bone ready for application to the soil, is $22 and at this cost I know that I have an absolutely pure article.

In the years since I erected my bone mill, I have used on an average five tons annually and as said, always with the most pronounced and profitable results.

I have been over all my tillable lands twice, applying from 500 to 1000 pounds to the acre, according to the condition of the soil.

The application of ground bone to the needy soil brings in the clover, it lightens the soil, and furnishes just those elements most needed by certain crops, and that are found to greatest extent in ground bone.

In recent seasons I have used clear nitrate of soda for my grass lands at the rate of 150 pounds to the acre at each spring dressing.

Not only have I been highly repaid by its use in increased amount of grass, but I find that when the nitrate of soda is used, the insect, which we generally speak of as the spit bug, does not come. If it be true that nitrate of soda is a sure bar to this insidious work, then this chemical will have to agriculture a two fold value.

There is yet another fertilizer of which I wish to speak and that somewhat in detail.

It is not a commercial article, but one produced upon every farm and wasted almost everywhere to a very material extent.

It is a fertilizer of the highest value, and in a form to be quickly available as plant food.

I wonder now, that I have allowed this important and valuable item of farm economy to go to waste, to the extent it has upon my farm, though it never did so on my farm more than it is doing to-day on the great majority of farms in New England.

Five years ago I adopted a plan for saving the liquid manure from my stables.

Previous to that time I had used various absorbents, always an expensive as well as unsatisfactory method and had striven to have as nearly as possible a water tight cellar bottom. But in some way or other much of the liquid manure would escape before reaching the designated field.

My plan for the saving of liquid manure comprehends a V shaped trough placed beneath the lintel of the barn and extending from under the barn to a brick cistern thirty feet away.

The cistern is made of brick, laid in cement and has a capacity of 250 barrels.

The top of the cistern is four feet above the level of the ground, and at this height above the cistern is a platform and reaching from this is a gang of three old style chain pumps all fastened on one shaft. The three when operated together empty into one common trough from whence it flows into a hogshead placed upon a cart.

The liquid manure I use wholly as a top dressing and its effect is simply astonishing.

The manure is applied by a machine of my own creation much after the manner of street sprinkling. The common sprinkler is not practicable as an attachment to a liquid manure distributor for the reason of its consistency.

My present distributor is one I adopted after first trying the street cart sprinkler. The hogshead holds eight barrels and twenty barrels will top dress an acre.

The entire labor of top dressing an acre is all well done in a single hour.

A familiar illustration of the quick and decided action of the liquid manure is that seen every spring and in every field where cattle have grazed the preceding fall, by patches of grass here and there that are conspicuous for their luxuriant growth and intensity of color.

The commercial value of this liquid manure is shown by the following analysis made at the Hatch Experiment Station:

| | | | |
|---|---|---|---|
| Compound | Water, | 93.25 | |
| | Ash, | 3.66 | |
| | Phosphoric Acid, | 0.24 | |
| | Potash, | 0.88 | |
| | Total Nitrogen | | 0.98 |
| | Nitrogen in the form of Ammonia, | | 0.65 |

This shows more potash and nitrogen and about as much phosphoric acid as are contained in the average stable manure.

According to this analysis a barrel of liquid manure is worth about fifty cents.

The amount of liquid manure saved annually upon my farm is about 350 barrels, representing a total commercial value of $175.

Muriate of potash is a commercial fertilizer with which I have had a considerable experience, and splendid success.

But to return to the subject of special forage crops, and to speak of one in particular; one that with the manner of saving, for cattle feed, has proved of utmost advantage to me, and with me, has been the factor above all others in making farming a success. I need perhaps scarcely to pause to tell you, that I refer to the silo and ensilage.

I first began the use of ensilage in 1880, eighteen years ago, so you will at least admit that I speak from experience in this matter. I was one of the first farmers in Massachusetts to build a silo.

When the first declaration was made, that green forage crops, especially corn, could be successfully stored, for winter use, I at once came to the conclusion that the idea was feasible, and a step along the line of agricultural advancement.

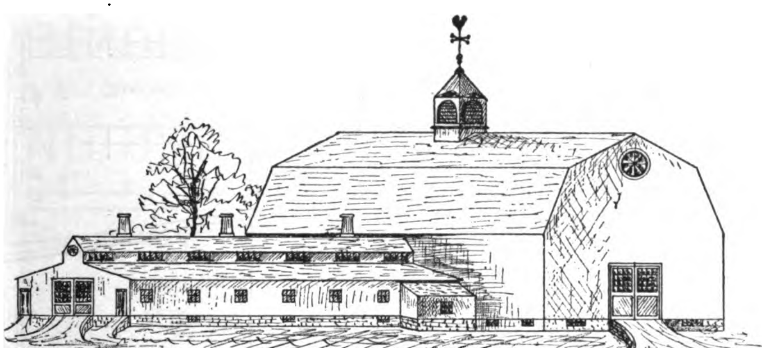
There can be no progress without the advent of new schemes, new ideas, and new principles.

Again, I thought that as the canning of fruit was a success and a long stride in advance of the dried commodity, so also might the principle in a measure, be applied to the preservation of forage crops. I made the experiment, and with me, it has been an abundant success.

For a number of seasons I grew exclusively Stowell's Evergreen sweet corn for ensilage, but more recently I have grown Leamings Southern corn. It is a comparatively new variety, large growing and has the desirable trait of producing an ear on every stalk. One season with another I grow eighteen tons of this corn to the acre. I harvest it for the silo when the ears are slightly glazed.

The power for my ensilage cutter is furnished by my engine boiler.

My method of feeding ensilage is to give a ration of about twenty pounds, morning and evening. My rule is to feed it with grain yet I have never observed the slightest reluctance on the part of my cows to eating it clear.



END AND SIDE ELEVATIONS

Indeed if there is any particular feed above another that a cow likes, it is a good article of ensilage.

My opinion based on my seventeen years' experience in feeding, as to the comparative value of ensilage is that three tons are equal to one ton of the best hay.

As a milk producing food ensilage is, in the light of my experience, just what cattle need in the winter season, and when we take cost of production into consideration, is superior to steamed fodder or roots.

The successful operation of a dairy farm, means that the pasture in summer and the hay loft in winter are not to be depended upon to keep up the required supply of milk.

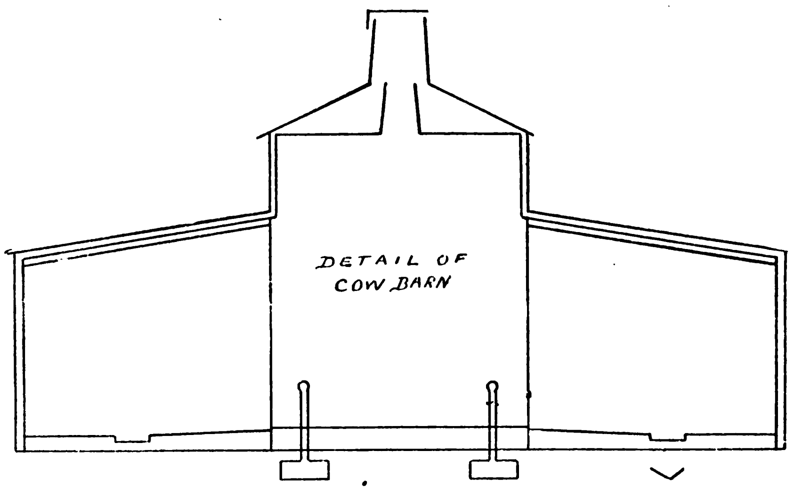
Even in early summer we must begin to supplement the pasture feed with some succulent forage crop.

For this first soiling ration I plant oats and peas together in the proportion of two bushels of oats to one bushel of peas.

They are sown as early in the spring as the ground can be worked, manuring with 15 loads of stable manure and taking special pains, as in fact I try to do with all my crops, to get the land thoroughly pulverized.

An acre of oats and peas will last a herd of twenty cows in connection with ordinary pasture feed from two to three weeks.

My next soiling crop is sweet corn, grown in drills three and a half feet apart and the plants six inches apart in the drills that I may get a stocky and nutritious substance.




When my field of sweet corn has disappeared I have then as a green forage crop for my cows a generous field of cabbage.

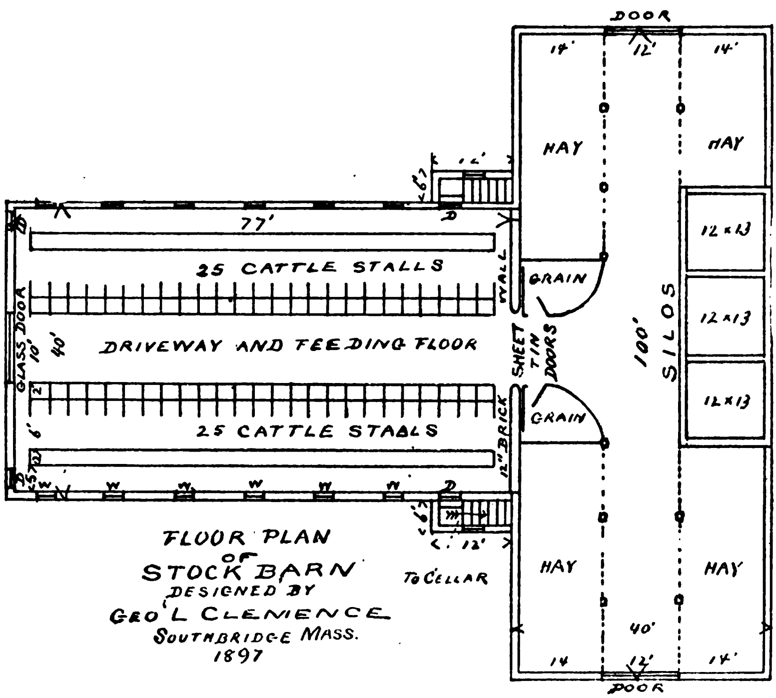
These I have fed to cows for a long term of years and always with the best results.

I raised the past season twenty-seven tons of cabbages harvesting them from two and one-half acres of land.

The hard marketable heads I sell in my local market but were there no market for these I would still grow cabbages for

my cattle. The leaves and unsalable heads pay the expense of cultivation, for they give one a succulent fodder some weeks after cold weather sets in.

For a main cabbage crop I decide upon a piece of land and in the fall or winter I manure at the rate of twenty-five loads to the acre.




In the spring I plough under the greensward and manure. A thorough harrowing follows and then I apply 200 pounds of muriate of potash to the acre. The muriate of potash makes a firm hard head of cabbage, much more so indeed than one would imagine.

The plants which have been raised in a bed by themselves, I set about the middle of June, using for this work a machine planter, the same as that employed by tobacco farmers.

This planting machine will set 2000 plants an hour. That I may save the entire crop of heads and at the same time pro-

long the time of feeding the leaves to my cows I begin about October 1st to make semi-weekly inspection of the field and harvest the mature heads.

Let me emphasize the always present question of economy in feeding, both in not suffering anything to be wasted, and in combining the food elements so as to obtain the best results.

This of course means to feed hay, straw, corn-stalks and other coarse fodders, in such quantities only as the animal will clean up every day, when put in the most appetizing form.

It means further that every prudent farmer will be a student of the feeding tables, and so combine his food stuffs that there shall be neither a large excess, nor a material deficiency in either albuminoids, protein, carbohydrates or fat.

Several years ago an eminent Professor in Harvard College, delivering a lecture on science, in defining his subject said, science was applied common sense. Now that is precisely the kind of science we farmers need to apply in compounding a ration for our cows.

We are taught by science, and it is proved by practical experience, that an average cow requires about twenty-five pounds of dry matter in her feed per day. Now as a basis of this feed, we must use such coarse fodder as we can readily grow, on our farms, such as silage, clover, English hay and so forth, but must add such concentrated feed as will make a properly balanced ration. Again science teaches us that the ration should contain two and one-fifth pounds of digestible protein, thirteen and one-half pounds digestible carbohydrates, and three-fourths of a pound digestable fat.

In compounding the ration for my cows I use as a basis forty pounds of corn ensilage and five pounds of hay, (a mixture of red top and timothy.) I find by the table that the organic matter contained in this ration is eleven and one-half pounds in the ensilage, four and one-half in the hay, making a total of sixteen or eight and one-half pounds short the amount laid down for the American standard, which must be made up by the use of concentrated feed. We also find it to be one and one-fourth

pounds short in protein, four and one-half pounds short in carbohydrates, and a little short in fat. Now by adding to the ration three pounds of wheat bran, five pounds of gluten meal and one pound of linseed meal we shall have a ration that contains twenty-four and three-fourths pounds of organic matter, two and seven-tenths pounds of protein, thirteen and one-fourth pounds carbohydrates and about the required amount of fat.

This ration is a trifle in excess in the amount of protein laid down by the table and a little short in carbohydrates but is a ration I find by experience to be well adapted to produce a generous flow of milk and of good quality.

During the first ten days of December, twenty-five cows in my herd consumed

| | |
|---|---|
| 6¼ tons ensilage cost | $12.50 |
| 1250 lbs. @ $16 " | 10.00 |
| 750 " Bran, | 3.75 |
| 1250 " Gluten, | 9.37 |
| 250 " Linseed, | 2.50 |
| | $38.12 |

Produced 2070 quarts of milk at 1 9-10 per quart for feed. (15¼ cents for feed to keep one cow per day.)

When and how to water cattle is a question that has long engaged the attention of the New England farmers and dairymen.

Yet how few are the instances where the method of watering cows differs from that in vogue a hundred years ago. Time was, when the practice of turning cows into the open barnyard in the dead of winter to drink through a hole cut in the ice was well nigh universal, and strange as it may seem, one occasionally sees a farmer in these days who follows this custom. He will tell you that it enables the cows to get fresh air and to become robust in health. But let me tell you such a farmer never has cows with big milk records.

The watering of my cows was a phase of my farming which early engaged my attention.

As soon as practicable I enclosed my barn cellar with interchangeable doors that the building might be made warmer and

that my cows might have a more comfortable place in which to drink than the open and exposed barnyard. I considered this, and rightly so, as a step in advance of the old method.

Later on having had placed in my residence a steam heater I considered the idea of a steam pipe to run from the boiler to the watering trough in the cellar.

I put the idea into practice, and I believe that I have done few more sensible and paying things on my farm. That warm water is desirable and every way better for cows than that usually given, is no guess work on my part, for I have learned it by actual and repeated tests. I have raised and lowered my supply of milk by changing from one to the other. The water which my cows drink in the winter time is maintained as nearly as possible at an even temperature.

Formerly my cows were watered twice a day but now they have it by them at all times, night and day, and it is always warm, fresh and clean.

A metallic pail is permanently placed between every two cows in my stock barn.

The main supply pipe coils around the boiler of the steam heater in my house and this is sufficient to keep the water at the desired temperature.

The amount of water which a cow drinks at one time when turned out but once or twice a day, is, I believe unnaturally large, and never attended by the best results. The amount she drinks at a time when it is by her at all times is surprisingly small, rarely more than two to four quarts.

When my cows are housed for the winter, they are carded once a day. For bedding I use dry saw dust.

The establishment of a milk route pre supposes a continuous supply of milk.

The quantity in winter must not be materially less than in summer, for the demand of customers varies but little from one season to another.

Modern farming as contrasted with the system of farming of fifty or sixty years ago, at once recognized the necessity for a

different and better housing and care of cattle in winter than were provided in the days when the growing of stock for beef was the principal feature of the State's agriculture.

The butter maker as well as the milkman sought under the new method to provide a warmer barn, for every one argued that if a maximum flow of milk was to be obtained all possible cold must be kept from the barn.

Hence it was soon the fact that the average barn was not only cold proof, but actually to an appreciable extent air tight.

We have been wont to indulge in self-gratulation over the warmth and absence of air drafts in our cow stables and we have pointed with pride to the fact that when a measure of warm air was once in our barns there was no chance for it to escape and make place for cool fresh air.

All this was in accordance with the teachings of the agricultural papers and the agricultural colleges.

But grief and great pecuniary loss are the result of an acceptance of these teachings.

In providing warm quarters for our cows we neglected the all important arrangement for ventilation and we have come to know that a cow must have sunlight and air if she would be kept in perfect health.

Because of the deprivation of these health giving and health preserving principles the farmers of Massachusetts are to-day contending with that terrible scourge among cattle, tuberculosis.

I believe that the majority if not all authorities agree that sunlight and air will prevent the existence of the germs of tuberculosis.

If this be true, and there is almost every reason to establish its truth, then our duty in the premises is plainly manifest.

We must ventilate our barns and keep them neat and clean.

This we can do and at the same time keep them warm and comfortable.

Many writers try very hard to enforce the idea that cows kept in warm quarters and highly fed are more subject to tuberculosis than those constantly in the open air.

All admit that all cows are not alike susceptible to the disease, even when alike exposed to bacilli.

Unquestionably anything which causes a low state of vitality predisposes the cow to the disease.

While a cow with robust health and vigorous circulation might be flooded with the bacilli and throw them off unharmed, another cow, or the same cow even when a little out of sorts from any cause of low vitality, might furnish an inviting field for the bacilli to take root and produce tuberculosis. Hence it is clear that all conditions which tend to promote most robust health are not favorable to the contraction of the disease.

If therefore constant exposure to the open air is most conducive to good health, then our forefathers in their forest homes with no means of sheltering their cows were wiser than we are with all our advantages.

But is it true that exposure to cold is conducive to health? Statistics show that the American Indians born and brought up in the open air, die with tuberculosis in greater numbers than do people that live in comfortable homes.

Anything which tends to the comfort of the animal tends also to its good health.

Of course I am aware that to shut cows in a close, small, ill-ventilated stable, so cold that the cow has to shiver for exercise to keep from freezing, does not make good health.

Neither does such a stable tend to her comfort, and when asked if I would not allow cows so kept to go out an hour or two daily for exercise and to get fresh air and a little sunshine, I would most assuredly say yes, anything is better than such a stable, better by far to leave them out altogether than to put them in such a stable for an hour.

But if we make the stable sufficiently roomy and provide ample ventilation, let in plenty of light and sunshine, make it warm and comfortable, provide good bedding and plenty of fresh water, the cows in such quarters will produce the most milk for the food consumed and be much less liable to be inoculated with the germs of tuberculosis.

Q. What do you say about salting the dairy cow; what is your method?

A. We salt our cows in the winter season twice a week. In the summer season we have boxes arranged with hard rock salt where they can go to it as wanted. We salt them more or less as they seem to want it.

Mr. Messer: Where are the silos constructed?

A. In the old barn directly opposite this point here, (indicating on chart) the silage is conducted by a track through into this part of the barn. (Indicating.)

Governor Grout: This table that you speak of here has a solid board bottom?

Mr. Clemence: Yes sir.

Governor Grout: Nothing but the atmosphere over it?

A. No sir.

Governor Grout: Those cleats are little dividers?

A. Yes sir.

Q. Is there any trouble from this liquid manure freezing?

A. No sir. When you put liquid manure on the ground directly before a rain or while it does rain, or in the winter, it is all right. But if you put it on directly after the first crop is removed, or if it is put on when the sun shines, it will burn as quick as acid.

Q. Wouldn't tile be good for that drain?

A. It clogs. In removing it this pump stirs it up in the cistern just about enough so it will pass the pump readily.

Q. You spoke of the importance of getting rid of the weeds. How do you obtain clean grass seed and clover seed?

A. I buy it in the market and have not had any trouble. Once in a while there will be a daisy, and I tell the boys when they see a daisy to stop and pull it.

Q. Do you keep the cattle in the stable during the summer?

A. Yes, and find it a very good practice to keep them in the barn during the middle of the day during July. They get all the feed they want by turning them out about half past five and

returning them to the barn at half past ten. We leave them in the barn until after they are milked, or about five o'clock p. m., and then turn them out. I secured from the old Fire Company a quantity of discarded hose that they had no further use for. I put three widths of this under the cow's forward feet. It is soft for the feet, and soft for the knees when they lie down.

Mr. Messer: How far are these troughs from the bottom?

A. At the south end they come up to the floor as near as possible with just pitch enough to flow off.

Mr. Curtis: How deep is the drop?

A. Six inches.

Q. With holes in the bottom of the drop?

A. Yes sir.

Q. How do you drop the manure into the cellar without getting it into the trough?

A. The scuttles are hung with a hinge, just wide enough to clear the side of the drop.

Q. How wide is the scuttle?

A. The drop is two feet wide.

Q. The scuttle about eight or ten inches wide?

A. I think mine is eleven inches wide.

Q. What is your pitch for the floor?

A. I think about two inches. The place where the forward feet stand is level, and from there I think it slopes about two inches.

Mr. Sanford: What would you say about the stable being on level ground, and drawing the manure into the field every day?

A. I think that is the proper way when it can be readily done.

Q. What would you say to the use of a cement floor.

A. I do not think it is as good, and I do not think it is as durable.

Q. You do not use sawdust for bedding?

A. Yes, we do.

Q. Do you keep your cattle tied all winter?

A. I have extra sized yards. My milk-room is located

sixty-five feet from the barn, and this covered portion is in the southeast corner, and makes a desirable yard ; and I also roof this yard over, putting a close roof on so that I can let them out stormy days if I wish to. The yard is not large enough for them all and I have to put out part at a time. If they were dehorned I could let out more at a time.

Q. Do you believe in dehorning ?

A. Yes, I really believe in dehorning, but I am changing cattle so often that I do not practice it.

Q. What breed of cattle do you keep ?

A. I have no particular breed. I want a good cow, one that gives a good flow of milk of good quality. I mean to raise my good heifer calves. The cow that I like best is a cross between the Shorthorn and the Ayrshire, and if she contains a little Jersey it will do no hurt.

Q. How much room do you give each cow in the stable ?

A. About three feet and four inches. . The cows are tied with three stanchions, and one Buckley watering devise between each two cows. The water is supplied by a cistern on the hill. When the water starts from the house it is heated to about one hundred degrees, but in passing through the pipes it reaches the stable at about fifty degrees.

Q. If it gets below fifty degrees do you lose milk?

A. Yes, but it does not get much below fifty.

Q. Have you experimented so that you think you could get a little more milk at sixty than at fifty degrees ?

A. I presume I might for a little while, but I think that is a little too warm for the cows and I do not think it would be quite as healthy for the herd. You would be surprised, by holding your hand above this air duct, to see what a draught of air comes through there in a still day.

Q. Your draughts from the stable, are at the top of the stable?

A. Yes, you will see by this arrangement that the down current is prevented from falling on the cattle.

Q. What is the height of the stable?

A. I think on the out side it is seven feet and on the other side it is nine feet.

Q. How often do you remove the manure from the cellar?

A. In the spring and fall.

Q. Does it heat?

A. No, not in the least.

Q. Do you keep any hogs in the cellar?

A. No sir, I fill this space under the floor full.

Q. How do you keep cabbage leaves?

A. I will try to explain my method for keeping cabbage leaves. I inspect the field in October and cut out everything that is in any danger of bursting and put it into cold storage. I take a space in this southeast corner (indicating) and fill it with ice. This is arranged to hold twenty tons of ice. In the fall, about the first of October, when we get ready to harvest our cabbage we place them underneath this receptacle for the ice which gives us a very good cold storage for the cabbage. The temperature through the month of October will not be far from forty degrees. In that way we can have a continuous feed of cabbage leaves from the first of October up to Thanksgiving time, and there is nothing I can feed that will produce as much milk as cabbage.

Q. What is the relative value of cabbage as compared with corn?

A. It is worth a third more.

Q. Does it have any effect upon the butter or milk?

A. No sir. One can feed a large quantity and not do any injury.

Q. What is the relative cost in raising cabbage and corn?

A. But very little difference with a machine to set them out. I think this machine costs ordinarily $50. It carries water and waters the plants as they are set. It pays for itself the first season. I used it in a very dry season and I did not lose five per cent. of the cabbage set. With this machine I can set a thousand in an hour.

Mr. Sanford: You do not say anything about clover hay?

A. I prize clover hay very highly. Some of us have a hobby, and with some of us it is a bicycle. Mine is a stable, and I intend to have a good stable, well finished inside with a good deal of fancy work that there is no need of putting in. A gentleman called upon me a few weeks after I built my stable and, looking it over, wanted to know how much it cost. I told him that since I had been in the milk business I had saved enough by not using tobacco or whiskey to build it and I was satisfied that a young man who went into the business about the same time I did, had since then spent more money for those two articles than the cost of my stable.

Mr. Sanford: How much did your stable cost?

A. Two thousand dollars.

Q. Aside from the barn?

A. Yes sir.

Mr. Bell: What does this cabbage setter look like?

A. I cannot explain it to you. It is really a tobacco setter but it works better for cabbage than for tobacco.

Q. At what time do you set cabbage?

A. All the way from the last of June to the middle of July where the fields are level enough so I can. I put the manure on in the winter.

Q. How far apart do you set the plants?

A. Three feet apart for the rows and two feet apart in the rows; 6000 to 7000 on an acre.

Q. What is your soil?

A. Subsoil merl.

Q. Do you market your cabbage in the winter?

A. I have the largest market in the fall. In the town where I live there are a good many foreigners, and they put in their vegetables all about the same time.

Mr. Sanford: Is muriate of potash the only chemical you use for cabbage?

A. Yes sir.

Q. Does the cabbage worm trouble your crop?

A. No, and the only reason they do not, I think, is becaue we have more cabbages than there are worms.

Q. Do you have any insect enemy?

A. No sir, not for the cabbage; but I do not believe in continually placing them on the same piece of land, one year after another. Sometimes just as the plants are coming up there is a little black fly that will injure the plants.

Q. What variety of cabbage do you raise?

A. The main crop is the Stone and the Mason.

Mr. Sanford: Do you make any use of plaster about the stable?

A. Yes sir, but perhaps not as much as I ought to.

## GOVERNOR GROUT'S ADDRESS.

*Mr. President, Ladies and Gentlemen:*

About a year ago I attended a meeting of the Board of Agriculture at Brattleboro. That was the last Board meeting of the year of 1897, and now I am attending the last Board meeting of the year of 1898, at Morrisville, in the town of Morristown. I count it fortunate to have been, and to be, thus honored. I cannot help according these towns high places among the towns of the State, as being inhabited by people who know their own wishes, their own desires, and in a thoroughly practical and business like way, know how to secure them. These towns, because of these peculiar habits and other features, will stand in my estimation to the society and life of Vermont much as Mansfield and Camel's Hump do to her beautiful scenery, as towering mountains of firmness, so characteristic of our people which gives them a reputation wherever they go. It is pleasant to meet the people under the auspices of the Board of Agriculture, a Board composed of intelligent, high minded, honorable men in their practices and work, that is well calculated to assist the farmer in moving along the way of his life a little more easily and smoothly, and to inculcate a standard, from which at least no harm can come, and only good ought to accrue. I wish to congratulate the people upon the opportunity and privilege they have under the laws of the State of possessing such a Board, for it is their property, and I wish to congratulate the Board upon the faithfulness and industry with which they have carried out their undertakings and endeavors; and I wish to congratulate the farming industry of the State which they represent, for the substantial benefits that have come to it under the tuition and direction of this Board.

I notice from your programme that your other speakers have all had a list of subjects, to which they have been invited

to train their thoughts, while I am permitted to remark and ramble about. This is a courtesy, but, my friends, it does not make it any easier. It is easier to be told what to say than to say what you ought. I must not, though, allow myself to drift or float idly and aimlessly, so that after the adjournment you will have nothing to think about, and from my little experiences in endeavoring to make impressions upon the minds of others, about as good a way to have them remember something is to scold them a little. The farmer labors and labors day after day, month after month and year after year, out in the sunshine and storm and wind, and the like, and he has not so very much of the earth's goods to show for his labor. Quite a limited requitement in many instances. This is practically true. It is of course easy, after a disappointment, to scold and find fault, but often times you will find the cause of your disappointment with the disappointed. Considerable of this, my friends, is because you do not know how to produce to the best advantage what you have to sell, and some way or other you do not know how to get the most out of what you can offer in the market. It is frost bitten, perhaps at both ends, and sometimes the middle badly contracted and shriveled. You have had a little practical talk this afternoon desirable and instructive, directing you along certain ways in which you can get more out of what you have to sell and get it more easily and cheaply. You want to produce to the best advantage, and then you want to sell to the best advantage, so you see methods and markets are important factors with the farmer.

I noticed the other day, in the New England Farmer, a very interesting account of my friend Sanford's farm, provided or furnished by my friend Messer. It was a sort of mutual admiration affair. A member of the Board, being entertained by a member of the Board, became inspired and wrote him up, as the expression has it; and so you have the account. It is instructive and I will use it in trying to tell you about the markets. I notice that friend Sanford's cows yielded him $90 each a year. Now at the average price of butter in 1897 those cows

must have given a great deal of milk for they made nearly 500 pounds per cow. I do not believe his cows yielded 500 pounds of butter upon the average during 1897. I will tell you how it happened. It is undoubtedly true that they yielded $90 gross, but he got nearer thirty cents for his butter than eighteen cents, and that will give him a chance for his cows to be very good ones and make a paying yield, if he fed them rightly. It is not so much in the man or the cow, or the feed, as it is in the market. Friend Sanford is an industrious, pushing farmer; one of the best in the State. I consider that and recognize the fact, but it is not so much in the feed, that he either raises or buys, as it is that he lives down there near North Adams, which is a better market than we have. That helps out. Under whatever circumstances or conditions, you should press on and press up for a better market, and when you hear of a man who is getting fifty cents a pound for his butter and start out hoping to get fifty cents for yours, you may find yourselves looking through the darkness of that night that has no morning.

Do not strive for the fifty cents a pound. I tell you, go to work with the farm and raise forage crops that will take good care of the dairy summer and winter, pretty much without any mill feed that you have to buy. Keep all that little outgo of cash in your pocket. Get some good cows; feed them carefully, and get all you can out of them and then turn what you get to the best possible account. That is the line on which the farmer can head up hill, or down hill. You want to strike a practical level, a practical basis for it all.

Now, so much for the market and so much for the feed. I want to tell every meeting of farmers about it that I can reach. You forget another thing, and one of the most destructive elements to agricultural endeavors, and that is the adulterated stuff you have to compete with in the market where your products go. If you are getting a good article of butter, some little rascal comes around and makes a counterfeit and gets nearly or quite as much money for his spurious article as you do for the genuine. In the Boston market tons of oleo are sold. You thought you had oleo

floored but it has kept right on and quietly touches elbows with butter in our market. You enact a law that it must be called this or that, but he will beat you every time and the laws we are enforcing as to tax and color have proved of no especial benefit to us. I want to tell you, as mortal men and women, if you want to become clean from these things you must clean them out with your own hands and not trust to legislative action to do it. You want to make butter and have it put on the market and sold as butter. This is the last time I will have a chance to talk to you during this administration, and it may not come amiss to say that if the farmers have been negligent in any way it is that you have not carried this thing out as you ought to. You want to make your butter without coloring matter. And you want a law that everything that is made to represent butter shall be made without coloring, and then you can go into the market and tell the difference between bad and good without trouble. It is discouraging and a shame that you should sell your butter against counterfeit stuff, and that you should sell your sugar against glucose, and that you should sell your horses against electricity, and that you should sell your hogs against cottolene. My friends, you never can fight a clean battle until you cleanse your own hands in this respect; the principle in our laws that the plaintiff must go into court with clean hands or he cannot have a verdict, means that you must make honest butter. I guess I have said enough, because you don't care much about it any way. It is a little sweet morsel which you roll under your tongues, a beam which you must cast out of your own eye, before you undertake to remove the mote from your neighbor's eye.

Another thing which is money to you: New Hampshire has realized this, and other States are realizing it. It is the summer traveler, the summer visitor, the fellow who gets tired of city life and wants to get a sniff of pure air out in the country, and has found that Vermont is the Switzerland of America, with its clear water its clear skies, invigorating air, green hills and beautiful scenery; the most beautiful spot, I say, on earth, and don't you dispute me. (Applause.) It is Vermont. We are entitled to our share

of these visitors, and we do not ask them to come. New Hampshire provides an appropriation, I am told. Vermont would laugh at the idea. When we get them here and show them the pure delights, such as Vermont life affords in the very nature of the case, we will keep them, but they are not coming up here on pilgrimages, to find out what we have; let us tell them and take them by the hand and bring them here. This, I understand, is quite an enterprise, and you are averse to it as farmers; as a rule you are afraid of such movements. It only requires that you take hold with strong hands and willing hearts for the improvement of your own surroundings. You want more and better roads in the State of Vermont. (Applause.) You don't know what that means any more than you know what taking coloring matter out of butter means. (Applause.) But you want better roads, and let me tell you that along the turnpike, beside the good smooth road you will find the best farms, worth 10, 20, 30 or even 40 per cent. more than they are back on the hill. Now do not be in a hurry about this. Do not build roads at the rate of two thousand or three thousand dollars a mile. I guess you do not need to be told that; and no doubt will come to it in time, slow but sure. You will finally settle down to building a class of good roads at two, three, four or five hundred dollars per mile, according to the surrounding conditions; roads that will stay until your grand children come along and wonder if they are copied from those old ways over in Italy, which have stood for, I don't know how many centuries. We want that kind of road. You are largely throwing away your money on the other. You have been spending thousands of dollars every year repairing the old roads. What is that story about putting wine into old bottles? Put the patch onto the old garment and it will move off soon and carry two-thirds of the garment with it. (Laughter.) I have got the jury on my side at last and I see you take kindly to scolding about roads.

These times threaten war. I have been inquired of a great many times what the prospect is for war. Will the troops be called out? Have Governors been instructed to get ready for action? And so on. There is a little excitement, my friends, and

I want to say a word or two about it. In my opinion it is largely sensational, and I hope we will not run too rapidly into war. I will tell you what the matter is with the American people. It is a commendable feeling that controls them, and keeps them on this top-wave of almost a spirit of war and a readiness to go at a moment's warning. I will tell you what it is: It is the patriotism of Bunker Hill. It is the inborn spirit of liberty, planted in the heart of the Anglo-Saxon; in the exercise of which, in establishing this government, those men, our Puritan fathers, behaved better than men ever behaved before in all the history of the world. We see the same spirit in the struggling Cubans, and we sympathize with them, and I have several times prayed to God that they might be given better wisdom by which they might be led as surely to the hill-top of liberty as were our ancestors. Their nationality is different, yet it is the same thing they are contending for and after they have contended long enough, and not a great while after now, either, Uncle Sam is going to extend his great hand of power to that oppressed people and they will have their liberty. (Applause.) And if the troops are not under arms anywhere, the people are imbued with a disposition and spirit that wherever the flag of liberty, wherever the banner of freedom is trailed in the dust, they are ready to carry guns and as soldiers defend it. (Applause.) Such is our duty here in this country and we simply want to keep cool and perform it when needed. Take it easy, and those at Washington will solve the whole matter, in my opinion; and not for the fun of it, my dear friends, do we want war. No, we have had our lesson in this generation, and many a relic of that lesson, taught by its severity is now with us. That which goes with death and destruction follows in the wake of war and remains to testify to its barbarities. We want no war unless it becomes a necessity and we will not have war unless necessary to defend our national honor and protect the flag we all adore.

I want to thank you for your kind attention and say to the Board, this is our closing-out work; I want to say to them that as I have heard from them and their work, over the State, that the people each year are drawing a little nearer to them. I want

to say to the people, come up nearer, all of you. There is a little difference of opinion, which you ought to be able to cover up and forget forever, and when that is done the Board of Agriculture will be one of the most acceptable and most valuable institutions of our Green Mountain State. (Applause.)

# FARM HOMES.

By Alpha Messer, Member of the Board.

After some preliminary remarks, referring to the inability of the Governor to be present as was expected, and to a change of topics for the speaker, Mr. Messer said in part: While it might be interesting to present a word picture of the farm homes of the nation, as they have come under my observation, I shall confine myself this evening more particularly to the farm houses of Vermont, and try to draw some lessons for the future from the past and present conditions and environments, but in passing I wish to say, that loyalty to home is one of the notable characteristics of the American people, and especially of the American farmer. The California farmer is just as loyal to his farm home in the "Golden State," as is the Vermont farmer to his Green Mountain home. The same is true of the Kansan in the "Sunflower State," the Ohio farmer in the "Buckeye State," and of farmers in every other State in the Union. It is this affinity for the soil, this love of home, which makes our people so intensely patriotic. Patriotism is love of home, and love of home is patriotism. The words are interchangeable, in either position they have the same meaning.

In regard to the farm homes of Vermont, I wish in the first place to present a few statistics, showing some of the past and present material conditions of these homes. I am well aware that statistics are sometimes dry and uninteresting, but the few that I shall present are so intimately connected with the development of the agricultural interests of our State, that I trust I may be pardoned for using them in this connection. I first wish to call your attention to the number of farm homes in this State, and note their increase and decrease since 1850 which is the earliest census record that we have in this connection.

In 1850 the number of farm homes in our State was 29,763. From this time there was a gradual increase up to 1880, when the number was 35,522, being the largest number of farm homes in the history of the State. From 1880 to 1890 farming conditions were changed somewhat, and the number was reduced to 32,573. Possibly to-day the number is still less, but I apprehend that it remains about the same.

The inference that we can reasonably draw from these figures, is, that as farming conditions were generally favorable and fairly remunerative from 1850 to 1880, a larger number of people sought this vocation as a means of livelihood, and the larger farms were cut up into smaller ones, and unimproved land was taken up and brought under cultivation. But with the advent of "hard times" beginning in the early eighties, and the extremely low price of farm products which followed, farming became less remunerative; many farmers sought other avocations, or became wage earners on other farms. Many of the hilly and less productive farms were consolidated with the productive ones or used for pastures. In this same connection, a glance at the average acreage of farms may be of interest. In 1850 the average size of the farms in Vermont was 139 acres, in 1860 135 acres, in 1870 134 acres, in 1880 137 acres, in 1890 135 acres.

The question of farm tenantry is one that is assuming considerable proportions in some parts of the country, and some economic students profess to see in it alarming symptoms which they think may develop into a condition of tenantry and semi-serfdom that will in time reduce our farming population to the abject condition of the agricultural population in some of the countries of Continental Europe. But I do not share in this pessimistic belief. While in some sections of the country the high price of land, in proportion to the value of farm products, and other conditions, are such as to temporarily increase farm tenantry for a limited area, yet I firmly believe that small holdings of real estate, will in the future, as in the past, always prevail in this country and that our farming population will become more intelligent and more independent, and that the owners of farm homes

will increase rather than decrease in the years to come. In our own State the number of farms worked by their owners is 27,816 and the number of rented farms is only 4,757.

Some of the most interesting statistics in regard to the farm homes of Vermont relate to their valuation. In 1850 the valuation of the farm homes of the State was $63,367,227. In 1860 it was $94,289,045, an increase of a little more than thirty millions of dollars. From 1860 to 1870 which included the period of the civil war, the valuation went up to $139,367,075, an increase of of over forty-five millions of dollars in ten years, and doubling the valuation of 1850, with over nine millions to spare. But it should be borne in mind that much of this increase in valuation was due to the inflated war prices, resulting from our depreciated currency at that time, and that sooner or later these abnormal prices would be changed to normal conditions, just as water is sure to seek its own level. Consequently, it is not strange that from 1870 to 1880 there should be a decrease in the valuation, not only of real estate, but of all other kinds of property as well, and we find the farm valuation to have gone back in ten years to $109,-34,6010. But the depreciation in farm values and farm property did not stop here. Sometimes the receding wave gathers momentum from the wind, or from other sources and goes beyond its natural or normal condition. This I believe to have been true of the valuation of farm property in Vermont, and we find that the valuation of our farm homes in 1890 was reduced to $80,827,490 which is a little more than thirteen millions less than the valuation in 1860. I apprehend that the farm valuation to-day will vary but little from these figures. Now let us stop for a moment and see if we cannot analyze some of the conditions which caused this remarkable reduction in the valuation of our farm homes. I said a moment ago that farm valuations in our State went below their normal condition ; for I find that in comparing the capacity and productiveness of our farms with those in other States, especially the Central and Eastern States, that they are lower in proportion to their increment than the farms in almost any other section of the country, and this leads me to say that from a wide experi-

ence of travel and observation in nearly all the States in the Union, I believe that Vermont offers better inducements for a young man to buy a farm, and engage in farming, and build for himself and his family a home in the truest sense of the word, than can be found anywhere else in all this broad land of ours, and I am glad to note that during the past two years more young men in Vermont have turned their attention to farming, than in many of the preceding years.

But I am digressing. I want to call your attention to one of the leading factors in the greater reduction of our farm values. It was during the decade from 1880 to 1890, and a portion of the preceding decade, that Eastern people become intensely interested in Western development. Large fortunes were being made by cash investments in western town and city property, and large interest was promised for loans on farm property in all the new and partly settled portions of this extremely fertile section of our country. Vermonters were as eager as any to double their incomes by investments in city lots, and to receive extremely high rates of interest for loans on farm property. As a result thousands, tens of thousands, hundreds of thousands, yes, millions of dollars went out from Vermont to build up western towns, and to develop agricultural resources. Much of this money was invested at home in farm mortgages, and other investments at six per cent interest. But this looked small to the money lender in comparison with twelve and fifteen per cent, which was promised, and for a time paid by the western speculator and farmer. The result was that real estate loans in Vermont were called in by scores; mortgages were forēclosed and hundreds of farms were placed on the market without any buyers, and their sales were forced, to the great loss of their former partial owners. These unfavorable conditions had a direct tendency to reduce farm values below their real worth for farming purposes. In addition to this, hundreds of the bright young men and women from the farm homes of the State, were attracted to the west by the greater inducements of wealth and the probable positions of trust and honor that were before them. But what Vermont lost in this way was the country's gain, for where-

ever these young men and women went, they carried with them a nobility of thought and soul, a character of sterling worth, that had been formed in the farm homes of the State, and which made its impress upon society wherever they went. It is not strange that with "hard times" and these causes combined, the farm homes of the State should have been depleted to a certain extent, and that from about 1888 to 1892 or '93, the cry of "deserted farms" should have been heard in the State. The people had been praising the West and deriding their own State, until those unacquainted with Vermont and its resources came to look upon it as a cold, sterile, unforbidding section of the country, and a most undesirable place in which to live. But thank God, times have changed somewhat, and with them the sentiment of the people also. Today capital in Vermont is not seeking investment in Western securities. The great losses in this direction have been a severe object lesson to investors. What would have been the result if the money from this State, which has been lost in the West and the South, had been used to develop the manufacturing and agricultural interests of Vermont, can only be conjectured.

Instead of saying mean things about Vermont the people today are talking about the good things we have; the pure and bracing atmosphere, the clear, health-giving-crystal springs that are gushing from our hillsides, the babbling brooks, the tumbling waterfalls, and a scenery that for beauty and loveliness is unsurpassed in any part of the world. In addition to this our farms produce more grain per acre, and our products are of better quality than in most other sections of the country. In butter production, Vermont leads the world in the amount per cow, and in the quality of the product. In the production of maple sugar and syrup, no State can equal ours in the amount produced or in the high standard of its excellence. Is it any wonder that the farm homes of our State are highly prized by their owners, and that their value is gradually increasing year by year. Much more might be said in this direction.

But I have spoken thus far only in regard to the material conditions and environments of the farm homes of our State. There

is another, and perhaps more important side which I wish to consider for a brief time and that is the influence of our farm homes in the character building of the people of our State and nation. As a people, it may be that we are prone to look too much upon the money side of life, and to use the most of our energies for the accumulation of wealth, regardless of the moral and higher obligations that rest upon, us and as a result wealth instead of character becomes an easy passport into what is called the "best society." This sordid sentiment seems to pervade all classes and conditions of society. It is found among farmers as well as among business and professional men, but it becomes more noticeable in our great centers of trade and of commerce, where colossal fortunes are sometimes made and lost in a short time. I have sometimes thought that this sordid money making sentiment which has such a strong hold upon our American people, was one of the weaker links in the great chain of liberty which binds us together as a nation and that if this link should be broken, our nation, which to-day is in the vanguard of civilization, would in time lose its existence as a nation and be known in history only as the ancient republics of Greece and Rome. But I am not pessimistic in my nature. I am an optimist and I like to look upon the bright side of life, and so, notwithstanding some of the unfavorable aspects in the trend of our nation, I have great faith in the American people, and especially in the American farmer, who I believe holds the key to the situation, in his opportunities for the development of the character of future generations in the farm home. There is no place on earth is so well adapted to the growth and development of that kind of manly and womanly character which the country needs to-day, as the home of the intelligent, industrious farmer.

If we study the history of our State and nation, and note the names of illustrious men which adorn its pages, we shall find that nearly all of them were born upon the farm. If we go to the great centres of trade and of commerce, and meet the men who transact the business of the nation, or if we come in contact with men of thought and high standing, who are leaders in the various professions, we shall find that nearly all of them were born upon

the farm, or only one generation from it, and that their strength of character and nobility of thought and soul, come from the blood of their sturdy ancestry, and from their early training in the farm home.

It is an encouraging sign of the times to know that greater efforts are being made to increase the attractiveness of the farm homes of our State and nation, and to make them more than ever before the abodes of contentment, of peace, of love and of happiness, and the nurseries of that exalted type of manly and womanly character, which is the rarest and purest gem that can adorn humanity in any station in life, or any condition of society.

# ECONOMICAL DAIRY FOODS.

JOSEPH L. HILLS.

The following discussion of economical methods of dairy feeding resembles somewhat a custard pie. First there is the under crust—some six pages or so of a rather heavy mass of facts concerning the science of stock feeding. Upheld by this crust is the custard—some twenty pages or more of practical considerations touching choice of foods, which reads more easily, and, like the custard, is more succulent that the heavy foundation which underlies it. And, finally, as nutmeg sprinkled over the top, come a few suggestions touching the advisability of a feeding-stuff control. From my boyhood up I have been fond of custard pie—for the sake of the custard. To this day I leave the crust uneaten. My readers are free to do likewise in partaking of this literary dish. They may, if they will, leave unread the close condensation of scientific matter given under the heading "Fundamentals of Stock Feeding," and begin with the "Functions of Farm and of Market" (page 104). They can perhaps digest the latter more easily than the former. Yet just as no cook would allow that her pie crust is not as light, flaky and wholesome as her neighbor's, the present writer feels that those who will and can eat crust as well as custard, who will "read, mark and inwardly digest" the foundation facts of the science of stock feeding as here given, should have a better idea of what constitutes proper dairy feeding and will be more likely to know what is and what is not true economy therein.

## FUNDAMENTALS OF STOCK FEEDING.

I think it will be helpful at the outset if we have a clear conception of certain underlying principles regarding stock feeding. Let us therefore devote a little time to discussing:

1. The composition of the animal body.
2. The ingredients of vegetable matter.
3. The functions in the animal economy of the principle ingredients of food.
4. Feeding standards.

### 1. THE ANIMAL BODY.

The body of an animal, be it ox or oyster, is made up essentially of water, ash (bony matter), protein, (lean meat) and fat. The proportion of these constituents in the bodies of various classes of animals differs widely, and it is also variable in the same class at different ages.

Water is the main constituent in point of quantity, is indispensable to the life functions, yet, since it has little economic importance, for the present purpose it may be disregarded.

Ash is used mainly in building up the skeleton. While of evident importance it exists in sufficient quantities in almost every conceivable ration, hence, like the water, may be dismissed as unimportant in the present discussion.

Protein is a term applied to a group of materials best typified in the animal body by the dry matter of lean meat, the cartilagenous matter of tendons, etc. This constituent is of vital importance in stock feeding, and will be constantly referred to throughout this article.

Fat is less important to vital processes than are the other three ingredients, yet of great economic interest.

### 2. VEGETABLE MATTER.

Inasmuch as all flesh is grass it naturally follows that the constituents of vegetable matter are not unlike those already described. All materials of a vegetable nature contain water, ash, protein and fat and, also, crude fibre (cellulose) and nitrogen-free extract matter.

It may not be amiss to describe these materials briefly.

Water is the result of the chemical union of two gases, oxygen and hydrogen.

Ash is a general term used to include the materials left when vegetable matter has been burned. The ash of wood or any other vegetable materials contains mainly carbonates of potassium, sodium, calcium, (lime) silicic acid (sand), etc.

Protein is a term used to include those materials which contain nitrogen and which alone are able to form the muscular tissues of the body. As a type of this material may be cited the gluten of wheat, that gummy material which when flour is kneaded enables the housewife to make it into dough. The white of the egg and the curd of skim milk are further examples of this most valuable constituent of human and of cattle food.

Crude fiber or celluose is the material which makes up the woody fiber, the frame work of the vegetable body. For instance the trunk of a tree is mainly composed of this or of kindred materials. Its digestibility is relatively slight and hence it has but little feeding value.

Nitrogen-free extract matter is the term used to include such non-nitrogenous constituents as are dissolved from dry powdered fodder by solvents of moderate strength. It is a sort of chemical "catch all" within which, for want of a better term, are included starch, dextrin, sugars, gums, and the like.

Fat, or, as it is better termed, ether extract consists of those materials which are dissolved from the ground fodder by boiling ether. It contains the true fats, resins, chlorophyl (the green coloring matter of plants) etc.

These three ingredients have certain common characteristics are often grouped together under the general name "carbohydrates" and are so referred to in the remainder of this discussion.

### 3. FUNCTIONS OF FOOD INGREDIENTS.

We may now very properly consider what are the functions of the ingredients of the food in the building up of the animal frame or in the manufacture of milk. It may be said parenthetically that these functions are much the same for either purpose. Milk is formed either by the breaking down of the mammary gland or

from the blood or by both processes. It is probably true that rations well adapted to the making of flesh are also good for milk making.

We need only consider the functional activities of protein and of carbohydrates.

The functions of protein are five fold.

(*a.*) From it are formed flesh, tendons, cartilage, etc., and the nitrogenous constituents of milk (casein, albumen, etc.)

(*b.*) It forms body fat and perhaps at times milk fat.

(*c.*) It furnishes material for the production of heat to maintain bodily warmth.

(*d.*) It furnishes material for the production of muscular energy.

(*e.*) It is held by some to be a stimulant to milk production.

(*a.*) The primary function of protein is to be found in the formation of flesh. Without it no muscular tissue can be developed. Animals fed on materials devoid of protein have starved in the midst of plenty. Flesh can no more be made in the absence of protein than can silk purses be made from sows' ears.

(*b.*) (*c.*) (*d.*) These three functions, the formation of body fat, the furnishing of heat and of muscular energy may very properly be termed the secondary functions of protein, inasmuch as these offices can be performed more successfully and more cheaply by the carbohydrates.

(*e.*) It has long been known that, within certain limits, the more highly nitrogenous the ration, the greater its value as a milk maker. Protein, in other words, seems to act somewhat in the manner of a milk stimulant.

The functions of the carbohydrates are four in number:

(*a.*) It forms body fat.

(*b.*) It furnishes material for the production of heat to maintain bodily warmth.

(*c.*) It furnishes material for the production of muscular energy.

(*d.*) It is not improbably a main supply of material from which milk fat is made.

There is no one function of the carbohydrates which, like the flesh forming function of the protein, can be considered more important than the others. The first three functions are all of the utmost importance to the animal economy.

(*a.*) It has been very thoroughly proven that the fat of the body is mainly derived from the carbohydrates of the food, and but seldom from the protein unless the former be in small quantity, a condition seldom occurring in ordinary practice. This statement is probably correct not only of the true fats of the food but also of the nitrogen-free extract matter (starch, sugar, etc.) Indeed animals have been fatted on rations containing far less actual fat than was formed in the body. While fat may be formed from protein, this ingredient is at least no better fitted for this purpose than are the carbohydrates and, since it costs several times as much as does the latter to grow or to buy, its use for this purpose is obviously not economical.

(*b.*) Carbohydrates serve as the main supply of fuel wherewith to maintain bodily heat. A certain temperature is necessary for the functional activities of the animal body. If for any cause it falls below a certain point or through fever it increases beyond a certain point, death generally ensues. This heat is kept up by the destruction or burning of certain food ingredients in the body. If sugar or starch were burned in a stove, they would evolve more or less heat, and would form, among other things, carbonic acid gas. If, instead of being burned, the starch and sugar were eaten, they would be consumed by the vital processes of the animal, the same amount of heat would be formed, and the same chemical compounds result as in the burning. Combustion would be slower, but the results would be the same.

(*c.*) Whenever there is any decided exertion of muscular force it is accompanied by greatly increased expenditure of the carbohydrates. The nitrogenous materials suffer but little loss. Of course they are necessary, yet the carbohydrates appear to be the material most vitally concerned. Fat more than any

other one constituent of the body appears to be available for this purpose.

(*d.*) Some investigators have claimed that the fat of milk was derived from the protein in the food, others that the food fat alone was concerned, while still others maintain that the carbohydrates in general furnish the raw material for the butter fat. While this point is by no means fully settled, the experiments recently reported by Director Jordan in Bulletin No. 132 of the New York (Geneva) Experiment Station go far towards proving that carbohydrates other than the fat are mainly concerned in the formation of milk fat. In this experiment a cow was fed for three months on a ration containing less than 6 pounds of digestible fat, yet she gave in her milk 63 pounds of fat. This extra fat could not have come from previously stored bodily fat, since the cow gained 47 pounds in weight, and was judged to be fatter at the end than at the opening of the trial instead of being thinner. In this case the starches, sugar, etc., must have been the source of the milk fat.

## 4. FEEDING STANDARDS.

Since protein is preëminently the flesh-forming and the carbohydrates the heat-producing food constituents, it naturally follows that certain proportions of these are best adapted to enable animals most satisfactorily to perform their functions. Just what is this proportion is a question which has received more consideration than almost any other one problem in the whole domain of experimental agriculture. Yet the chances are that no dogmatic statement can ever be made which will be exactly right for all classes of animals or be more than simply a help and a guide in stock feeding. Absolute rules, infallibly correct, applicable under all conditions and to all animals, can never be laid down. Feeding standards have been proposed by several different investigators for different classes of farm animals. Thus we have one for an ox at rest; another for the same animal at work; others for a horse at light, at medium and at hard work; yet others for milch cows, for sheep

and for pigs. Indeed of recent years dietaries or standards have been proposed in human feeding. Perhaps fifty years from now the science of the feeding of human beings will have been sufficiently advanced to enable us to prescribe a different ration for the preacher than for the pugilist.

These statements on feeding standards are simply crystalizations of experimental results into mathematical formulæ. They are based upon greater or less amounts of work, many upon little data, while others are the result of many investigations of the most rigid type.

The feeding standards most widely accepted are the so-called German or Wolff standards. The German standard ration for the 1000 pound cow, calls for 24 pounds of dry matter, 2.5 pounds of digestible protein, 12.5 pounds of digestible carbohydrates and 0.4 of a pound of digestible fat. Wolff's experiments were made many years ago with German cows, with German fodders and feeds and under German conditions. Many American investigators question the usefulness of these standards with American cows, feeds and environments. The tendency in this country has been if anything towards widening this ration, towards lessening the proportional amount of digestible protein.

The distinction should be made, however, between maximum production and economical production. What the dairyman of to-day wants is not that ration which will force a cow to do her utmost regardless of the cost of the food and its effect upon the health of the animal, but that diet upon which the cow will make the largest amount of the cheapest butter. It may be better to make somewhat less butter and make it at less cost, than to make large quantities at high cost. It has been claimed that a thousand pounds of butter has been made from one cow in a year. Whether this claim is based upon facts or not, certainly the ration eaten was excessive and uneconomical. The German standard very properly does not consider the matter of economy. The cost of fodders and feeds varies in different localities and in different years and it would be impossible to fix a standard using

variables for the purpose. It is safe to say, however, that at present prices for concentrated feeds in the New England markets a fairly close approximation to the German standard has proven with high grade cows to be an economical ration.

## FUNCTIONS OF FARM AND OF MARKET.

Let us now begin to build our superstructure of good dairy feeding practice upon this foundation of scientific principles in stock feeding. Let us in the first place consider what are the proper functions of the farm and of the market in the matter of the economical feeding of dairy cows.

In another portion of this volume will be found an admirable address on stock feeding by Director Jordan of the New York station delivered before the Vermont Dairyman's Association. The director made an epigrammatical statement therein which is worthy of emphasis and reiteration. It seems to me that it strikes the key note of the successful dairy practice of to-day. He said that "the proper function of the farm in dairy feeding was that of a carbohydrate factory and the proper function of the market was that of a protein supply."

What did he mean by this statement? He meant three things:

(*a*.) That carbohydrates were grown upon the farm with relative ease but that it was difficult to grow enough protein upon the farm to feed a large number of animals and to balance the ration.

(*b*.) That as the by-products of several industries are notably rich in protein and are sold at reasonable prices, it was often cheaper to buy this material than to raise it.

(*c*.) That it was usually in the line of economy to endeavor to grow carbohydrates in as large amounts as possible, and to buy protein in order to supplement this growth, thus properly balancing the ration, provided the class of cows to which the ration was fed was of the proper grade.

## Classification of Fodders and Feeding Stuffs.

What may properly be termed economical and what uneconomical roughages? How shall we classify our feeding stuffs? This is to quite an extent a matter of personal judgment. I am perfectly willing to allow any one to disagree with me in the classifications which I shall offer.

### ECONOMICAL ROUGHAGES.

1. Early cut hay.
2. Silage from matured corn.
3. Oats and peas.
4. Clover.

### UNECONOMICAL ROUGHAGES.

1. Late cut hay.
2. Silage from immature corn.
3. Roots.
4. New and untried crops.

### ECONOMICAL CONCENTRATES.

1. Cottonseed meal.
2. Linseed meals.
3. Certain gluten meals and feeds.
4. Dried brewer's grains, malt sprouts, etc.
5. Bran, middlings, etc.
6. Corn meal (sometimes).

### UNECONOMICAL CONCENTRATES.

1. Cornmeal (usually.)
2. Oats.
3. Oat feeds.
4. Mixed feeds or provenders.
5. Condimental foods, etc.

Tables showing analyses and digestible ingredients of the materials considered in the present discussion are presented herewith. The reader may refer to them as needed.

AVERAGE COMPOSITION OF ROUGHAGES AND CONCENTRATES REFERRED TO IN THE PRESENT ARTICLE

| Classified as Economical Roughages | Moisture | Dry matter | Crude ash | Crude protein | Crude fiber | Nitrogen-free extract | Ether ext't |
|---|---|---|---|---|---|---|---|
| Early cut hay | 15.3 | 84.7 | 5.5 | 7.4 | 27.2 | 42.1 | 2.5 |
| Silage from mature corn | 77.9 | 22.1 | 1.5 | 2.0 | 5.6 | 12.2 | 0.8 |
| Oats and peas | 71.3 | 28.7 | 1.9 | 3.6 | 8.5 | 13.6 | 1.1 |
| Red clover hay | 15.3 | 84.7 | 6.2 | 12.3 | 24.8 | 38.1 | 3.3 |
| **Classified as Uneconomical Roughages** | | | | | | | |
| Late cut hay | 14.1 | 85.9 | 3.9 | 5.0 | 31.1 | 43.7 | 2.2 |
| Silage from immature corn | 85.7 | 14.3 | 1.9 | 1.4 | 4.6 | 5.6 | 0.8 |
| Roots—Beets | 88.5 | 11.5 | 1.0 | 1.5 | 0.9 | 8.0 | 0.1 |
| Carrots | 88.6 | 11.4 | 1.0 | 1.1 | 1.3 | 7.6 | 0.4 |
| Turnips | 90.5 | 9.5 | 0.8 | 1.1 | 1.2 | 6.2 | 0.2 |
| **Classified as Economical Concentrates** | | | | | | | |
| Cottonseed meal | 8.2 | 91.8 | 7.2 | 42.3 | 5.6 | 23.6 | 13.1 |
| Linseed meal (new process) | 10.1 | 89.9 | 5.8 | 33.2 | 9.5 | 38.4 | 3.0 |
| Linseed meal (old process) | 9.2 | 90.8 | 5.7 | 32.9 | 8.9 | 35.4 | 7.9 |
| Flax meal | 8.3 | 91.7 | 5.6 | 38.4 | 8.6 | 35.4 | 3.7 |
| Chicago gluten meal | 8.5 | 91.5 | 1.1 | 35.3 | 1.1 | 51.2 | 2.8 |
| Cream gluten meal | 8.0 | 92.0 | 1.0 | 34.3 | 1.7 | 53.2 | 2.7 |
| King gluten meal | 6.5 | 93.5 | 2.3 | 32.9 | 1.4 | 42.4 | 14.5 |
| Buffalo gluten feed | 9.0 | 91.0 | 1.0 | 28.2 | 6.6 | 52.4 | 2.8 |
| Golden gluten feed | 7.6 | 92.4 | 1.2 | 28.1 | 3.3 | 56.3 | 3.5 |
| Diamond gluten feed | 7.5 | 92.5 | 1.0 | 21.6 | 6.1 | 60.9 | 2.9 |
| Dried brewers' grains | 8.2 | 91.8 | 3.6 | 19.9 | 11.0 | 51.7 | 5.6 |
| Malt sprouts | 10.2 | 89.8 | 5.7 | 23.2 | 10.7 | 48.5 | 1.7 |
| Atlas gluten meal | 6.8 | 93.2 | 2.0 | 32.9 | 11.1 | 35.2 | 12.0 |
| Wheat bran | 11.9 | 88.1 | 5.8 | 15.4 | 9.0 | 53.9 | 4.0 |
| Wheat middlings | 12.1 | 87.9 | 3.3 | 15.6 | 4.6 | 60.4 | 4.0 |
| Corn meal | 15.0 | 85.0 | 1.4 | 9.2 | 1.9 | 68.7 | 3.8 |
| **Classified as Uneconomical Concentrates** | | | | | | | |
| Corn meal | 15.0 | 85.0 | 1.4 | 9.2 | 1.9 | 68.7 | 3.8 |
| Oats | 11.0 | 89.0 | 3.0 | 11.8 | 9.5 | 59.7 | 5.0 |
| Oat feeds* | 7.5 | 92.5 | 5.5 | 10.0 | 21.5 | 51.9 | 3.6 |
| Mixed feeds* | 9.8 | 90.2 | 4.4 | 14.2 | 7.9 | 59.1 | 4.6 |
| Condimental foods, etc., and mixed feeding stuffs† | 7-11 | 89-93 | 2-20 | 9-27 | 3-16 | 39-64 | 3-10 |

*Oat feeds and mixed feeds are sold under many different brands and if not adulterated are usually fairly uniform in composition.

†These special goods vary much in composition. A tabulation showing composition of 22 different kinds is given in the 1897 Year Book of the U. S. Department of Agriculture, page 425.

AVERAGE DIGESTIBLE CONSTITUENTS IN ROUGHAGES AND CONCENTRATES REFERRED TO IN THE PRESENT ARTICLE

| Classified as Economical Roughages | Protein | Carbohydrates | Ether extract |
|---|---|---|---|
| Early cut hay | 5.0 | 33.3 | 1.5 |
| Silage from mature corn | 1.3 | 14.1 | 0.6 |
| Oats and peas | 2.9 | 13.9 | 0.8 |
| Red clover hay | 6.8 | 22.4 | 1.6 |
| **Classified as Uneconomical Roughages** | | | |
| Late cut hay | 2.3 | 42.9 | 1.2 |
| Silage from immature corn | 0.8 | 7.0 | 0.6 |
| Roots—Beets | 1.2 | 8.8 | 0.1 |
| Carrots | 0.8 | 7.8 | 0.2 |
| Turnips | 1.0 | 8.1 | 0.2 |
| **Classified as Economical Concentrates** | | | |
| Cottonseed meal | 37.2 | 16.9 | 12.2 |
| Linseed meal (new process) | 28.2 | 40.1 | 2.8 |
| Linseed meal (old process) | 29.3 | 32.7 | 7.0 |
| Flax meal | | | |
| Gluten meals (in general) | 25.8 | 43.3 | 11.0 |
| Gluten feeds (in general) | 20.4 | 43.8 | 8.6 |
| Dried brewers' grains | 15.7 | 36.3 | 5.1 |
| Malt sprouts | 18.6 | 37.1 | 1.7 |
| Atlas gluten meal | 25.8 | 43.5 | 11.8 |
| Wheat bran | 12.2 | 39.2 | 2.7 |
| Wheat middlings | 12.8 | 53.0 | 3.4 |
| Corn meal | 7.0 | 65.2 | 3.3 |
| **Classified as Uneconomical Concentrates** | | | |
| Corn meal | 7.0 | 65.2 | 3.3 |
| Oats | 9.3 | 48.3 | 4.2 |
| Mixed feeds (corn and oats equal parts) | 7.4 | 61.2 | 3.7 |

Oat feeds and condimental feeds are not included for lack of data.

## ECONOMICAL ROUGHAGES.

### I. EARLY CUT HAY.

Early cut hay is to be preferred to a late cut crop purely on the gounds of quality. The dry matter of most if not all crops is relatively richer in protein in the early stages of its growth and in carbohydrates in the later stages. This point is well brought out in the following table, which shows the

analyses of the dry matter of timothy hay, cut at four different times. This table, as well as that which immediately follows, is taken from Bulletin No. 5, of the Illinois Experiment Station.

COMPOSITION OF DRY MATTER OF TIMOTHY HAY CUT AT DIFFERENT PERIODS

| | Crude ash | Crude protein | Crude fiber | Nitrogen-free extract | Ether extract |
|---|---|---|---|---|---|
| In full bloom | 6.81 | 7.33 | 32.11 | 48.75 | 5.00 |
| Anthers half-shed | 6.65 | 6.56 | 33.74 | 48.59 | 4.46 |
| Seed in dough | 6.73 | 6.12 | 34.45 | 48.89 | 3.81 |
| Seeds nearly ripe | 5.90 | 6.23 | 33.82 | 50.67 | 3.38 |

Owing in part to the harder coating of the stalk and seed, and the shelling of the seed, the late cut hay is less digestible than that cut early, so that this table understates rather than overstates the truth.

Attention has already been called to the difficulty of growing protein upon the farm. By cutting hay early one can do something towards increasing the farm protein supply and lessening grain bills. When hay is cut early, quantity has to be in some measure sacrificed to quality, or else in some cases extra work is involved in cutting a rowen crop. It may sometimes occur that one is so situated that it will be more economical to make but a single cutting thus saving labor. The farmer must balance extra labor against extra farm-grown protein and decide for himself.

The following table gives a fair indication of the hay and nutrient yields from timothy at four states of growth, showing that early cutting involves a sacrifice in gross tonnage. The increase in crop, however, is in the less costly carbohydrates. The extra crude fiber may be accounted to have but little feeding value.

HAY AND NUTRIENT YIELDS IN POUNDS PER ACRE

| | | Ash | Protein | Crude fiber | Nitrogen-free extract | Ether extract |
|---|---|---|---|---|---|---|
| In full bloom | 4480 | 224 | 240 | 1056 | 1602 | 165 |
| Anthers half-shed | 4320 | 228 | 225 | 1155 | 1663 | 152 |
| Seed in dough | 5240 | 273 | 246 | 1380 | 1960 | 153 |
| Seeds nearly ripe | 5180 | 239 | 253 | 1377 | 2058 | 137 |

2. SILAGE FROM MATURE CORN.

It was long ago clearly shown that the most economical farm-grown carbohydrates raised in New England are derived from the corn plant and that they are more economically perserved for cattle feeding in the silo than in any other way. Occasionally one finds a man who has used the silo and abandoned it, but such are exceptions to the rule. Those who are prejudiced against it have generally become so because of its mismanagement.

My associate, Mr. Curtis, sang the praises of the cornplant and the silo in such dulcet tones yesterday morning that I can hardly do more than play the accompaniment and say, "Me too." He gave the practical farmers' testimony. I may be excused therefore, if I confine my remarks simply to the experience of our own experiment station. For three years we harvested our corn crop experimentally in essentially the following manner: Taking our corn fields as a whole, one fourth of the crop was placed in the silo; another fourth was stooked; the ears were plucked from the third fourth and the stalks put in the silo; while the ears were plucked from the fourth fourth and the stalks stooked. The plucked ears were ground and the meal fed in connection with the stalks from which they came. Each year a number of cows were selected for the test, and something over thirty cows recorded their testimonies. Each year the cows were divided into four lots. The first lot was fed for four weeks on silage, then for the next four weeks on stover silage together with the meal which belonged thereto; for the next four weeks on corn fodder; for four weeks on corn stover and meal; and for the fifth four weeks were fed the same silage that they began on. Lots 2, 3 and 4 were fed the first four weeks respectively upon stover silage and meal, upon corn fodder, and upon corn stover and meal, were shifted from time to time to the other rations and finally wound up on the fifth four weeks on the material on which their experimental feeding began. Each year each cow said by the way of the milk pail and the

butter tub that she preferred to have the corn plant put in the silo, ears and all. Each year she gave more milk and butter on silage, ears and all in the silo, than when she was fed the corn plant harvested in any other way. Her testimony was unvarying that it was time and money worse than wasted to pluck the ears from the corn. The following table gives the condensed testimony of the various trials.

AREA OF CORN HANDLED IN VARIOUS WAYS NECESSARY TO FURNISH THE SAME MILK AND BUTTER YIELD AS AN ACRE OF SILAGE, EARS AND ALL IN THE SILO

| | Stover silage and meal | Corn fodder | Corn stover and meal |
|---|---|---|---|
| 1891 | | 1.07 | |
| 1892 | 1.26 | 1.08 | 1.26 |
| 1894 | 1.10 | | |

I can readily imagine that if field corn was planted that it might be unfitted for silage, that there might be necessity of plucking some ears. When, however, Sanford corn or some variety of that general type is allowed to stand until the kernels are just beginning to glaze, the silage ought to prove a satisfactory and an economical source of carbohydrates.

If the corn be cut before the glazing point of the kernels there is loss of potential food ingredients. If it stands much later, but little food is gained and there is considerable danger of frost. An experiment made at the Vermont station in 1892 bears testimony upon this point.

SANFORD CORN CUT AT VARIOUS STAGES OF GROWTH

| | Dry matter | Crude ash | Crude protein | Crude fiber | Nitrogen-free extract and ether extract |
|---|---|---|---|---|---|
| Tasselling | 2526 | 246 | 408 | 664 | 1208 |
| Roasting state | 4266 | 303 | 512 | 982 | 2468 |
| Nearly ready for silo | 6006 | 328 | 649 | 1287 | 3742 |
| Glazed | 6391 | 319 | 642 | 1194 | 4237 |

### 3. OATS AND PEAS.

The problem of pasture renovation is one that perplexes us all. Much of the land which once was rich in pasture feed is now given over to brakes and weeds and is more or less covered

with second growth. I am no prophet, yet I believe that it is the ultimate destiny of large tracts of land in this state hitherto used for pasture to revert to the forest for which, I think, the Almighty designed them. I think it is safe to say that many of the so-called "abandoned farms" should never have been farms, that they would prove more profitable as forest lands. I believe that economy will force Vermont farmers to lessen their pasture areas and to supplement them with the larger use of the soiling crops. The experiment stations in this and other countries have for many years been experimenting with various forage crops. It is one of the proper functions of the experiment station to make the farmers' mistakes for them and we have made at Burlington a good many mistakes in growing new and untried crops. We have yet to find a forage crop more valuable as a supplement to the pasture than are oats and peas. Silage fed three hundred and sixty-five days in the year is probably the most economical means of helping out the pasture, but for summer forage in Vermont oats and peas are a good second. Planted at intervals, say of ten days, this combination furnishes a very good supplement to the pasture. It is liked by the cattle and serves to keep up the milk flow. Good catches have been obtained by sowing the peas first and harrowing them in fairly deep and then putting the oats on separately, then harrowing or bushing them in. One bushel of oats to two bushels of peas is a good combination. They should be cut when the oats are just headed but before they begin to turn yellow. We have grown as high as 19 tons of green forage to the acre at the station farm with the following composition :

Dry matter 28.73, crude ash 1.94, crude protein 3.62, crude fiber 8.49, nitrogen free extract 13.58, ether extract 1.10.

It will be noted that this compares very favorably with early cut hay or even with clover hay. The crop is well relished by cattle fed green, as hay or ensiled.

### 4. CLOVER.

Whenever one can grow a good crop of clover it is one of the very best things for balancing the ration, for renovating the soil, and for helping out the pocket-book. As is well known, this crop is frequently difficult to grow. The reasons for its failure are not always easy to discern. Among them may be noted, however, a lack of lime or of potash in the soil, the absence of the nodule-forming bacteria, the acidity of the soil, etc. Vermont is probably located too far north to enable the farmer to grow the crimson clover successfully. The red and the alsike are of about even value. Clover is at its best when cut in its early bloom. It may be ensiled, but is none the better for being put through this process. If properly hayed it is in as good condition for preserving as if handled in any other way.

## UNECONOMICAL ROUGHAGES.

### 1. LATE CUT HAY.

Late cut hay is not an ideal feed for dairy stock, owing to the large increase of indigestible woody fiber which occurs as the crop approaches maturity. Experiments have clearly shown that there is little if any more digestible matter in a crop of late-cut than in one of early-cut hay, even though the latter be much larger in quantity. Its quality is notably inferior. It is obviously true that the farmer who has a large area of meadow land cannot cut the entire amount at just the right time; some must be cut too early and some too late. I have yet to hear, however, of the man who regretted starting his mowing machine too early in the year. The early bird catches the protein.

### 2. SILAGE FROM IMMATURE CORN.

The silo received a serious set back in its early days in this country because of the exceedingly wet, sour nature of the silage. Many costly silos were built and filled with immature corn. As a result this method of feeding animals become practically no more than an expensive way of watering cows. Cases have been known

where 90 per cent, even 92 and 93 per cent of water in immature corn was put in the silo. Note for instance the composition of the Red Cob corn on August 15 and on August 29, in the following table. This is a very fair type of the corn used largely twelve to fifteen years ago for silos and too frequently planted to-day. But 10 pounds of food in 100 pounds of silage, as against 25 to 30 pounds in the ideal silage of to-day.

COMPOSITION OF RED COB CORN AT VARIOUS STAGES OF GROWTH

| | | Water | Dry Matter |
|---|---|---|---|
| August 15. | Not tasselled.................. | 89.66 | 10.34 |
| August 29. | Tasselling ...................... | 88.58 | 11.42 |
| September 13. | Earing........................... | 83.42 | 16.58 |
| September 28. | Partly eared...... ............ | 80.96 | 19.04 |

Corn as wet as this is bound to sour and the silage has but little value. One should avoid this error and plant only such varieties as will allow about 25 per cent of dry matter to be placed in the silo. Such varieties should be chosen as will reach the point of glazing before the first frost. It may not be amiss to call attention here to the necessity of avoiding the other extreme of putting too much dry matter in the silo. If over-ripe corn be ensiled or much more than 30 per cent of dry matter is ensiled, one may reasonably expect more or less fire-fanging.

### 3. ROOTS.

Many farmers have a high opinion of the value of roots as a feed for cattle. This opinion in my judgment is not well founded. It will be a surprise to many to learn that some roots are as wet as skim milk. Mangel wurzels contain only about 9 pounds of dry matter in a hundred, while skim milk carries 9.5 pounds. Rutabagas and carrots run from 11 to 13 pounds of dry matter to the hundred. The feeder should remember that food is valuable in proportion to the amount of digestible dry matter it contains and that water in large quantities lessens its worth. These wet materials are consequently handicapped. They have a distinct value as appetizers and to those who have not built or will not build a silo. Others will usually find them a more expensive source of digestible carbohydrate than the corn crop.

### 4. NEW AND UNTRIED CROPS.

It seems folly for farmers to spend much time and money in growing largely of new and untried crops. The seedman's catalogues each year contain glowing descriptions of various newfangled crops of greater or less agricultural value. Sachalin, flat pea and a host of others of like ilk have had their day and the place thereof knows them no more. It is one of the provinces of the experiment station to make trials of this kind, to sift out the good from the bad. It were wiser for the farmer to counsel with the station before making large outlays for new crops and determine the probabilities of success or failure. Let the station make these mistakes rather than the farmers.

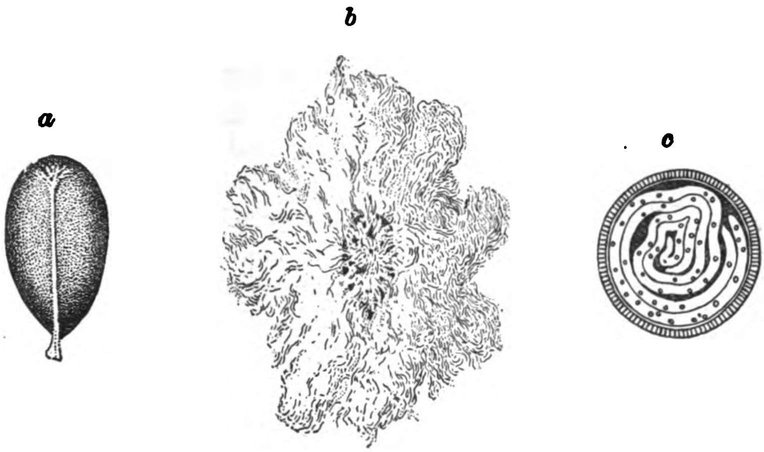
The four materials noted on the past few pages as economical farm-grown crops are distinctly carbohydrate in their nature. Granted that the early cutting of hay tends to add to its protein content, that oats and peas and clover are, as compared with other farm crops, decidedly nitrogenous; yet notwithstanding they are properly speaking of a carbohydrate nature. It was stated some pages back that the production of this material was the proper function of the farm. None of these materials can, as a rule, economically supply sufficient amounts of protein to meet the needs of large numbers of animals. Hence we must turn to the market for this protein supply and should govern our purchases largely, though not entirely, by the proportion of this ingredient in the materials offered.

## ECONOMICAL CONCENTRATES.

### 1. COTTONSEED MEAL.

This well known material is derived from the seed of the cotton plant. This seed, as will be noted from figure b. in the cut, comes from the plant covered with a coating of white down technically known as "linters." This being removed by a special process, leaves the seed as shown in figure a, covered with a thick hard black coating or hull, containing, as is shown

in figure c, the embryo or meat. In the process of manufacture of cottonseed oil, the hulls are removed, the meats cooked in a large kettle and, while still warm, wrapped up in hair cloth and

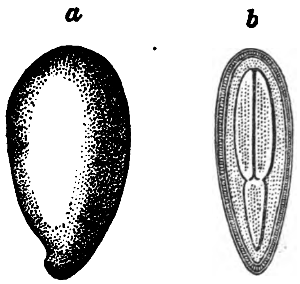



Cotton seed, magnified--a, seed delinted; b, seed with "linters" attached; c, cross section showing embryo or "meat." (Hicks. Div. Bot. U. S. Dept. Agr., Year Book 1895, p. 186.)

subjected to great hydraulic pressure in order to remove the oil. The pressed cake is then broken and ground, forming the bright lemon-yellow meal. As will be seen by the analysis and in the table showing digestible constituents, this material is the richest concentrate sold in the market. Reference to the table showing plant food contents in the fodders and feeds now under discussion shows it is similarly rich in plant food. This feeding stuff is very desirable as a means of narrowing the ration and bettering its service for dairy purposes. In brief it may be said that when fed in reasonable quantities together with other and proper feeding stuffs, satisfactory results may be secured with all farm animals except calves and swine. Care should be taken, however, that wet or mouldy meal be not fed. One should buy only that having a bright lemon-yellow color and a fresh, clean, nutty taste. Dull red, dull yellow or dull brown meals should be looked at with suspicion as they usually are either injured through being exposed to the air, have been overheated, are mouldy, or are adulterated.

### 2. LINSEED MEALS.

Linseed meals are the refuse remaining after the oil has been expressed or extracted from the flaxseed. These seeds are treated much in the same way as the cottonseeds for the extraction of oil. The new process meals have a larger proportion of the oil extracted, since in addition to hydraulic pressure naptha is used as an oil solvent. The so-called flax meal is practically but a variety of linseed meal which has been subjected to steam treatment. It is more coarse and flaky than the ordinary linseed meal. The linseeds, while at ruling prices somewhat more costly, are notably desirable. They are largely used as a basis of condimental feeds. They have a good effect upon the digestive system and, barring the tendency of softening the butter, which will be referred to later on, are in every way suitable for dairy feeding.




Flaxseed, magnified—a, seed; b, cross section (longitudinal) showing embryo or "meat." (From Hicks, Div. Bot. U. S. Dept. Agr. Year Book 1895, p. 188.)

### 3. GLUTEN MEALS AND FEEDS.

These materials are by-products of the manufacture of glucose. They are made essentially as follows: The whole corn is soaked in warm water for many hours until swollen and thoroughly softened. It is then run through stones set quite a distance apart. This rubs off the husk and the germ, and at the same time beats up the starch and the gluten. The mass is sifted through fine sieves, the starch and gluten passing through, the husk and the germ remaining behind to be separated, if desired, by gravity, the husks floating and the germs sinking in water. The starch and gluten which have passed through the sieves are separated by running into large tanks and settling, or by slowly running through long troughs. The starch, being heavier, settles to the bottom, while the lighter yellow gluten-containing material runs off from the top. The portions thus

separated form the gluten meal. When, as is frequently the case, the corn skins and germs are mixed with the meal, the material is termed gluten feed.

These goods have varied more or less in years past one brand from the other, but of late years they became quite uniform in composition and have been among the cheapest of our concentrates. The meals have as a rule been cheaper than the feeds in proportion to the food contents. As will be noted farther on these materials have sometimes been found to cause digestive troubles and injured the quality of butter, hence, while valuable when fed in moderate rations, they should not be fed in over large quantities.

### 4. DRIED BREWERS' GRAINS, MALT SPROUTS, ETC.

These refuse materials are distillery and brewery by-products. When dry they are safe to feed to milk cows and have been found to be quite cheap sources of protein. They are not so rich as cottonseed and linseed meals, yet are often cheaper than these two materials and are apt to be safer than the former one. Their effect upon the quality of the product is not as yet clearly defined. We have used the so-called Atlas gluten meal (a distillery by-product wrongly called gluten) at the experiment station for three years and have found it a desirable and economical form of protein. A few cows have not eaten it when fed in large quantities and one or two have utterly refused it even in the smallest quantities. Most of the animals have taken to it readily and done well upon it.

### 5. WHEAT BRAN AND WHEAT MIDDLINGS.

These materials are so well known, so widely used and their good qualities so generally appreciated that stress need not be laid upon them here. They are pre-eminently milk makers. I believe they are absolutely safe when fed in any possible quantities, they carry considerable percentages of protein and, at ruling prices, are in every way desirable dairy feeds.

### 6. CORN MEAL (SOMETIMES).

I have classified corn meal under both the economical and the uneconomical headings. Sometimes corn meal may be used to an advantage in the dairy ration. I find fault more particularly, however, with the extent of its use. I think it is wiser to feed corn in the form of silage rather than to pluck and grind the ear. If, however, the silage is deficient in corn it may be supplied in shape of meal. Indeed, up to the limit of making the ration too heating one may sometimes to advantage add corn meal to the ration even when the silage is well eared, more particularly because it tends to better the grain of butter.

## UNECONOMICAL CONCENTRATES.

### 1. CORN MEAL (USUALLY).

My associate, Mr. Williams, has spent a good deal of time during the past year in taking the statistics for Vermont touching the use of feeding stuffs for domestic animals. He finds that nearly $3,500,000 are spent annually for this class of materials, and that of this sum a million and a quarter are spent for western corn. I will freely grant that it may not infrequently prove worth while to buy western corn. I question, however, the wisdom of putting forty per cent of this money to this use. I have no hesitation in saying that as a rule corn may be grown more cheaply than it can be bought, that better service for the same expenditure would generally be obtained by the purchase of materials more nitrogenous and less carbohydrate in their nature. It is like carrying coals to Newcastle. The buyer of corn meal gets those ingredients which are most easily raised upon the farm and not those which the ration lacks. A million and a quarter is far too large a sum to spend for carbohydrates. It is an economic crime. The dairymen of this state need to awaken to this mistaken policy and in these days of close markets and low profits to buy what they want and not add to the stock of what they have.

## 2. OATS.

Mr. Williams finds that over half a million is paid out in the state each year for oats. Oats are an excellent dairy feed and well adapted for milk making. They are far better for this purpose than is corn. It may well be questioned, however, if they are economical at present prices as compared with other and richer concentrates.

## 3. OAT FEEDS.

A class of materials known as "oat feeds" has been sold or several years upon the Vermont market. These goods have usually had a fairly uniform composition and in states where analysis needs to be guaranteed they have been found to be as a rule all that they are promised to be. They are made up usually of more or less corn and oats with sometimes a mixture of some material like gluten meal that is richer in protein and they contain considerable quantities of oat hulls. Their excuse for existence is simply and solely as a means whereby oat-meal manufacturers may work off their by-products, such as oat hulls, light oats, etc. It seems as if it hardly needed argument that this class of material cannot be very economical at the prices asked. The food ingredients are not as cheap as in most other feeding stuffs, and I do not feel that they are to be recommended to dairymen.

## 4. MIXED FEEDS AND PROVENDERS.

Most of these materials are combinations in different proportions of corn and oats. Inasmuch as these two ingredients have already been considered separately, and classified as uneconomical, their mixtures are naturally to be placed under the same ban. It happens, moreover, that these mixtures have of late years been found ready means of disposing of oat hulls, and not infrequently mixed feeds are found upon the market which carry undue proportions of these hulls. Oat hulls have hardly more food value than ground toothpicks. If one desires to feed corn and oats, it is far better to have the materials ground by a miller whose responsibility can be vouched for than to buy ground materials.

### 5. CONDIMENTAL FOODS.

The list of condimental feeds, patent medicines and cure-alls for cattle, etc., is a long one. The late lamented P. T. Barnum once said "that the American public likes to be humbugged," but one who was greater than he, who guided the destinies of this nation through the civil war, said "you can fool all the people part of the time and part of the people all the time, but you cannot fool all the people all the time." This being the case I look forward to the day when this class of material will be relegated to the rear by intelligent farmers and be less widely used. It has been shown that condimental foods seldom if ever increase production or materially better the conditions of healthy animals. If animals are ailing it is generally wiser to consult a veterinarian than to doctor them with nostrums.

## FURTHER CONSIDERATIONS GUIDING CHOICE.

In the choice of economical concentrates one should bear in mind several points other than simply the protein content of the material, including·

1. Effect upon the health of the animal.
2. Effect upon the quality of the product.
3. Effect upon the quality of the manure.
4. Relation of cost to value.
5. Dairy character of the herd.

### 1. EFFECT UPON THE HEALTH OF THE ANIMAL.

The question is often asked, "how much cottonseed, linseed or gluten is it safe to feed to a cow?" This question cannot be dogmatically answered. One might as well ask "how much beefsteak can I eat without suffering a fit of indigestion?" The amount which may be safely fed is determined mainly by the individual makeup of the animal. We had a cow once in our herd which consumed an almost fabulous amount of cottonseed meal, while others have been thrown off their feed by two pounds a day. Linseed meals appear to be quite safe in any quantity. Cottonseeds and glutens in quantity will sometimes

tend to cause garget and fever. The only rule which can be safely given is to feed these materials with a sparing hand until the digestive capabilities of each animal are thoroughly gauged, then if one has high grade animals able to make large quantities of butter one can generally afford to feed up to the limit of healthful production.

### 2. EFFECT UPON THE QUALITY OF THE PRODUCT.

The quality of the butter or cheese, i. e., its grain and consistency, is affected sometimes by changes in feeding. Cottonseed products are apt to make butter hard, while linseeds and, as a rule, glutens, soften it. The effect of the distillery by-products is not as yet thoroughly understood. The intelligent feeder should know these points and govern himself accordingly.

### 3. EFFECT UPON THE QUALITY OF THE MANURE.

To the farmer who carefully observes the well known methods of preserving manure from fermentation and leaching. this point is of much importance. To him who does not try to follow modern methods in this respect it is of little value. The animal voids nothing that it does not eat or drink and its voidings are of a different quality, so far as plant food is concerned, in proportion to the variations in the food eaten. Rich food makes rich manure and poor food, poor manure. Cottonseed, linseeds, glutens, brans, distillery by-products, etc., are of distinct value in this respect, while corn meal and the like rank relatively low. The following table shows something of the manurial values of the various fodders and feeds considered in this article. It should not be supposed that every particle of the plant food will of necessity reach the soil. More or less, according to the care or lack of care with which the manure is handled, will be of use. It is fair to assume, however, that the losses will be proportional regardless of the quality of the manure.

PLANT FOOD IN POUNDS PER TON IN ROUGHAGES AND CONCENTRATES DESCRIBED IN THIS ARTICLE

| | Nitrogen | Phosphoric acid | Potash | Valuation* |
|---|---|---|---|---|
| Early cut hay | 30 | 9 | 16 | $ 5.24 |
| Silage from mature corn | 6 | 2 | 7 | 1.22 |
| Oats and peas (green) | 13 | 3 | 13 | 2.49 |
| Red clover hay | 41 | 7 | 44 | 7.89 |
| Late cut hay | 25 | 11 | 18 | 4.71 |
| Silage from immature corn | 4 | 2 | 6 | 1.00 |
| Roots — Beets | 5 | 2 | 8 | 1.12 |
| " Carrots | 3 | 2 | 10 | 0.93 |
| " Turnips | 4 | 2 | 10 | 1.07 |
| Cottonseed meal | 136 | 58 | 17 | 22.08 |
| Linseed meal (new process) | 116 | 37 | 28 | 18.91 |
| Linseed meal (old process) | 109 | 33 | 27 | 17.73 |
| Flax meal | 123 | 17 | 28 | 19.09 |
| Chicago gluten meal | 112 | 8 | 1 | 16.04 |
| Cream gluten meal | 110 | 7 | 4 | 15.86 |
| King gluten meal | 105 | 15 | 1 | 15.34 |
| Buffalo gluten meal | 90 | 6 | 2 | 12.92 |
| Golden gluten meal | 90 | 8 | 1 | 12.96 |
| Diamond gluten meal | 70 | 8 | 1 | 10.16 |
| Dried brewers' grain | 72 | 21 | 2 | 11.00 |
| Malt sprouts | 71 | 28 | 33 | 12.46 |
| Atlas gluten meal | 105 | 12 | 2 | 15.26 |
| Wheat bran | 53 | 58 | 32 | 11.10 |
| Wheat middlings | 53 | 19 | 13 | 8.73 |
| Corn meal | 36 | 14 | 8 | 5.92 |
| Oats | 41 | 16 | 12 | 6.88 |
| Oat feeds | 34 | 18 | 11 | 5.95 |
| Mixed feeds | 45 | 15 | 20 | 7.75 |

## 4. RELATION OF COST TO VALUE.

It is difficult to say dogmatically whether one or another grain feed relatively contains the most value for the dollar invested. It is impossible to apply a valuation system to feeding stuffs with the same degree of certainty with which it may be used with commercial fertilizers. Various attempts to do this

*Allowing 14 cents for nitrogen, 4 cents for phosphoric acid and 4¼ cents for potash, the prices at which these ingredients in forms of like availability could be bought in 1898 in the shape of crude stock for commercial fertilizers.

have been made with rather doubtful success. This failure is on the whole an advantage. It would be a misfortune were it ever possible to reduce the science of stock feeding to the condition of a branch of applied mathematics. It might then be carried out in a perfunctory manner; now it is a study worthy of a high order of intellect. Chemical analyses, feeding and digestion experiments and the like are helpful but cannot take the place of careful observation.

The selling prices of the various concentrates are not always, indeed they are seldom, gauged by their compositions. They are governed by considerations of supply and demand, and are, moreover, quite open to fluctuation. Hence it follows, since the proper function of the market is that of a protein supply and not a source of carbohydrates, that those materials rich in protein are usually the cheapest.

### 5. DAIRY CHARACTER OF THE HERD.

Quite as important as anything else in connection with economical dairy feeding, is the character of the cows. I do not care to take sides with the Jerseys, the Ayrshires, the Guernseys or the Holsteins. There are good and there are poor individuals in all breeds. It is folly, however, to feed high grade food to low grade cows. A herd giving at least 250 or, better, 300 pounds or more of butter to the cow in a year, may well be well fed. Dairying with such a herd, economically and properly fed, is still profitable.

## FEEDING-STUFFS CONTROL.

The question is sometimes asked whether there are sufficient variations in the composition of feeding stuffs, brought about by natural causes, changes in methods of manufacture or by adulteration, to make worth while a system of inspection of feeding-stuffs similar to that exercised over the commercial fertilizer trade. I think that this question may be properly answered in the affirmative.

Feeding-stuffs controls are already in operation in three of the New England states, and have for many years been in vogue

in European countries. The arguments in favor of a state control of feeding stuffs are briefly as follows:

1. The trade involves enormous sums. Approximately $3,500,000 a year is expended in Vermont for feeding stuffs for domestic animals.

2. The feeding stuffs sold are of many kinds, they often bear misleading names, and their selling prices are no certain index of their value as feeds.

3. Different feeding stuffs vary largely in composition one from another, while those of the same name may be widely apart in feeding values owing to differences brought about by (a) variations in the composition of the material from which they are derived; (b) by differences or changes in methods of manufacture; (c) by adulteration.

(4) Guaranteed compositions would tend to insure better values, wiser purchases and greater confidence. A feeding stuff control would aid in money saving and be of distinct educational advantage.

All the arguments favoring a control of the sale of commercial fertilizers are applicable to the present case.

The Director of the Maine Station states that "the most noticeable thing accomplished by the law is the driving out of the state the adulterated cottonseed meal which was so largely sold in 1897. The inspection law has driven it to other states." The chief chemist of the Rhode Island Station says "I regret to say that Rhode Island is becoming the dumping ground of adulterated cottonseed meal, etc." The Maine law has been found in experience to "protect both the dealer and the consumer" and to "tend toward a more rational use of feeding stuffs, which will be alike beneficial to the feeder and the dealer." Dr. Lindsey of the Massachusetts station states that "while fully one-third of all samples of cottonseed meal received at this station during 1897 proved to be seriously adulterated, thus far in 1898 not a single adulterated article has been discovered." He also says that "the inspection shows the feed stuffs to be comparatively free from serious adulteration. Some show

rather wide variations in composition, which it is hoped will be corrected in the future." Also "a great variety of oat refuse is now finding its way into our markets. It has been found to contain from 35 to nearly 60 per cent of hulls . . . farmers are cautioned against paying excessive prices for material of this kind."

The Maine law requires that manufacturers guarantee the protein and fat percentages of their foods and provides for their inspection and for the publication of results. The cost of its inforcement is defrayed by a tonnage tax of ten cents, all excess over a certain amount being covered into the state treasury. It is to be hoped that a similar law may soon be placed on Vermont statute books.

At another point in this volume will be found the resolution of the Vermont Dairyman's Association authorizing its legislative committee to favor before the next legislature the passage of a feeding-stuffs inspection bill. I was appointed a member of this committee. The bill, if introduced, will probably follow the lines of the very successful law now in force in Maine. The director of the Maine station tells me that this law has proven of distinct benefit, that it has not raised the prices of feeding stuffs to the farmer, that it has been of distinct advantage to dealers and consumers alike, that its execution has not been difficult, and that, in short, he does not see wherein such a law should not be an advantage in any dairy state. Taking the statistical report of Mr. Williams, already referred to, as a basis, it is probably safe to say that a tax of five cents a ton would more than cover the costs of inspection and would turn a considerable revenue into the state treasury. I think that the farmers of the state will freely admit that the Dairyman's Association, the State Board of Agriculture and the Experiment Station, (all of which organizations are heartily in favor of some enactment of this nature) have no selfish ends to serve in this matter but that the several officials connected therewith sincerely believe that such a law would be of service to the farmers of the state, as has been the similar one touching the control of commercial fertilizers.

## THE UTILITY OF BEAUTY.

By Rowland E. Robinson.

Constantly in season and out of season we urge the making and maintenance of good roads and the neatness of our villages as the chief means of attracting tourists and summer residents to our state. We forget that people of esthetic tastes are not drawn to an unsightly region for the sake of its roads, however good, except that they make leaving it the easier, and that dwellers in cities do not come to the country merely to look at smaller towns. They desire to be led through green pastures, by pleasant waters, to fair towns that sit in the midst of picturesque scenery, and these we should be able to offer, since nature has given us so largely of her beauty, not for us to destroy nor spoil, but to preserve if we would make the best use of the gift.

A noble mountain does not lose all the grandeur when stripped of its green garment of forest, but it does lose much of its beauty, as it does of its usefulness. The rain and snow that fall upon it are no longer held for the gradual feeding of springs and streams, but sweep down the valleys in sudden, destructive floods to-day, and to-morrow leave the starved stream creeping feebly in the track of devastation.

A ledge clad with trees is a delight to the eye, a beautiful home of birds and flowers, a play ground for children, a place for the lover of nature to wander in. Naked, it is ugly, inviting no one, nourishing only scant herbage and noxious weeds.

Better than denuding such an outcrop of rock for the present gain of a few cords of wood is a judicious pruning out of dead and dying trees without materially changing the character of the place.

Rivers nourish a growth of water-loving trees upon their banks, and the trees repay them with shade that retards evaporation, with a network of roots that hold the banks from caving, and with a charm a stream cannot have without them. As inseparably linked along the stream, so about the shores of pond and lakes, use and beauty stand hand in hand, so interdependent that if we spoil one we destroy the other.

If not quite so strong a plea can be made for the trees along the highways, it cannot be denied that they beautify the thoroughfare as nothing else can, and that their shade is grateful to the traveller.

These should be sufficient arguments for their preservation and their protection from mutilation by the telegraph and telephone companies who are quite too regardless of public and private rights that conflict with their own convenience.

There is a common prejudice among farmers against meadow and pasture trees, yet it is a pity that fine specimens should be sacrificed to it when they add a charm to the landscape, and give such grateful shade to the hot and weary hay-maker, and to the panting flocks and herds, while the kindly tree gives back to the soil all that it takes of moisture and fertility.

Trees are the shelter and home of many of the birds who are the farmer's friends, destroyers of insects and devourers of the seeds of noxious weeds, charmers of the eye and ear with pretty ways and sweet songs. Surely such friends are worthy of all encouragement and protection. In this connection let it be urged that the heron, the bittern and the noble eagle should be saved from the wanton destruction that now pursues them and threatens to rob our streams and lakes of the last vestige of wild life. They are so worthless dead, so comparatively harmless alive, that they might well be given absolute legal protection, and no longer be the target of any thoughtless gunner.

The old rail and board fences, picturesque in decay with moss and lichen and fringe of elder and briers are passing away to give place to the utilitarian wire fences and the fiat of removal

has gone forth against the most unique of barriers, the pine root fence, that once bounded fields and bordered roadsides like walls of mighty antlers garlanded with woodbine, grape vine and clematis, a feature of our landscape so strange and picturesque the unaccustomed eye dwells upon it with wonder and pleasure. It is practically indestructible except by fire and flood, and pray let us save it where we can for the admiration of our visitors, for ourselves and our children, a memento of the giant pines that our forefathers of the New Hampshire Grants were enjoined to reserve for the masting of King George's navy.

Let us save the trees, the birds, the beauty of the streams and of the everlasting hills, so that the stranger who looks in at our gates may desire to enter, and that our children may be left an inheritance wherein beauty and utility abide together.

# PAPERS FROM MEETING OF VERMONT HORTICULTURAL SOCIETY.

## PRUNING THE PLUM TREE AND THINNING THE FRUIT.

By A. A. Halladay, Bellows Falls, at Middlebury Meeting.

The first illustrated lesson in close pruning came to me some thirty years ago. My father bought a farm of a man who, like many others, bought trees of nearly every tree agent that came along, and set them out on land that was worthless for any purpose. Some four or five years previous to my father's purchase the man had bought some eighteen or twenty plum trees and set them close to a picket fence at one side of a lane, where his horse was pastured. You can probably imagine the result. Not a sprout from one of the trees got above the top of those fence pickets. When my father came to the farm the trunks of the trees were from three to four inches in diameter with heads not over four feet from the ground, and as flat on top as if cut with pruning shears. All these years the trees had been making roots and not branches. The fence was moved back several feet, and the trees protected from stock and it was truly wonderful the growth those trees made. They formed low, wide, branching heads, and produced annually large crops of the very choicest fruit. In the fifteen years my father owned this farm, there was only one year that these trees failed to produce a money crop of from fifty to one hundred dollars worth of fruit. I have always looked upon this as "Horse Sense" in pruning plum trees.

My method of pruning plums can be given in a few words. To cut back all leading shoots of the new wood at least *two-thirds.*

This is my rule and I follow it as closely as circumstances will admit. I would not, however, dare send a man into my orchard with instructions to follow this rule to the letter, for there is not, and can not be, any set rule for pruning. Different varieties requiring different treatment; for instance the Burbank, being naturally of a low, sprawling habit,requires more side and less top pruning than the Abundance, which is an upright grower and should be severely top pruned so as to spread the top as much as possible.

If *large* trees are bought from the nurseries, the heads will be formed too high, and the tree will never be of the proper shape. I always prefer the small one year trees, then I can shape the heads to my ideal. I would rather have a small one year tree three feet high with all its roots, than a ten foot tree with only a third of its roots. My ideal plum tree has a low, spreading, well balanced head, with a large, straight, smooth body that is not more than two feet from the ground to the lowest branches. By cutting back severely at the time of planting, and taking off one-third of each season's growth, I can generally secure trees of this shape. Such trees give me well ripened wood, bear better crops of better fruit, are more vigorous, longer lived, bear more regularly, and it does not cost more than one-half for the labor of caring for the trees and gathering the fruit, because most of this labor can be performed from the ground instead of from long ladders.

The past season has quite fully demonstrated the great advantages of this close pruning system over the more common method of letting the trees take care of themselves. While the tall, slim, unpruned trees of my neighbors were bending their long, willowy branches to the ground with their over-load of fruit which was so small and poor that it could not be sold at any price, and with a large number of the trees dead, and all of them permanently injured, my own trees were loaded with the very choicest fruit I have ever grown, or seen anywhere. Not a single tree was in the least over-loaded and not a prop was needed in my

orchard, and these same trees, while producing this heavy crop of fruit, have made from three to six feet of new wood, and have plenty of fruit buds formed for a crop next season, while the trees of my neighbors that are not already dead will not bear another crop for three or four years at least. A plum tree well pruned will have three times the amount of bearing wood that the unpruned tree will have.

Some of the advantages of low over high pruning are: The low branches prevent the trunk and larger branches from becoming sunburned. It brings the fruit near the ground, thereby saving at least 50 per cent in the cost of gathering. The trees and fruit are much better protected from hard winds, and the fruit not so badly injured if it falls to the ground. A low spreading tree is better balanced, and in seasons of heavy yields will not need any support, and the fruit will be more evenly distributed over the tree. Still another advantage of low heads is that they keep the plow and cultivator farther from the trees and thus save many of the roots that would otherwise be destroyed. A low head is usually an open head which admits of more sunlight and therefore better colored fruit is obtained. If our trees are low the fruit will be far more likely to get thinned than if we have to climb a twenty-foot ladder in order to reach it.

I believe that if we train our trees to low heads, and properly thin the fruit, taking off and destroying all inferior, wormy specimens, and make it a rule never to prop up a tree, we will have very few "*off years*," and will always find a ready sale for our fruit at the highest market prices.

### THINNING FRUIT.

That all tree fruits are greatly benefited by thinning in seasons like the one just past, I feel certain will be conceded by every one. Yet it is a lamentable fact that comparatively few fruit growers practice thinning their fruit. With many, fruit growing is only a side issue. The farmer will no doubt tell us he cannot afford to spend the time, or that it is wasteful to destroy

so much fruit. Now I will try and prove that any one who has fruit *can* afford to spend the time, and that it is exceedingly wasteful *not* to relieve his overburdened trees of a part of their load.

The past season has furnished a good object lesson in this line. In my thirty years of plum growing I have never before known of so large a crop of plums as was started in 1897, and I have never seen *so few good plums* in our market as last fall. This poor fruit can be traced directly to lack of thinning the fruit. In my section, I believe it safe to say that at least three-fourths of all the plum trees are either dead or permanently injured from over production. In one orchard of over 150 Lombard trees, every tree was as bare of leaves in July as they are now in January. The trees were loaded with fruit that shrivelled up and colored before it was over half size. Many of the trees broke down and many of the branches bent to the ground. After the trees were ruined the owner shook off the fruit, put it into *barrels* and tried to sell it. These were all young and thrifty trees, planted four, five and six years ago, and I should consider them worth at a low figure at least $5.00 a tree, and the fruit, if properly thinned, say $2.50 a tree after paying for picking. This would be $750.00 for the trees and $375.00 for the fruit, a total of $1125.00

The owner's excuse for not thinning was that he could not afford the time, that he had to hoe his corn. Yet his entire crop of corn and fodder would not have sold for $100 after it was harvested. Do you think this man could afford to thin his plums?

There were many other similar cases that came under my observation the past season. If our trees are worth anything *we must thin the fruit.* Not only is this necessary for the good of the trees, but for the production of the *best fruit; second class* fruit is not worth raising.

Five years ago I sold my old place, with one of the best paying plum orchards in southern Vermont, and bought new land, built new buildings, and started a new orchard, therefore at the

present time none of my trees are over five years from the nursery, but many of them have been giving me good crops for three years.

My rule is (and I live up to it) never to allow a tree to be so overloaded as to require to be propped, or that the branches bend very severely. In thinning, I begin when the fruit is about the size of a pea, going over it from time to time taking off all defective specimens, and thinning out so that no two will touch. This thinning may continue with profit until the fruit is ripe, by taking off and destroying all of the wormy or stung fruit.

Every time a tree overbears its vitality is weakened to that extent that it never fully recovers from the shock, even if it is not killed outright. The fruit will be inferior both in size and quality, and must be sold at a price correspondingly low. The quality being poor, customers will soon lose their appetites for it and thus the demand will yearly grow less. The markets of the world are never glutted with *good fruit*, it is the poor stuff that spoils our markets.

I have a Burbank plum tree, set three years ago last spring, which measures eight and a half feet high, and its branches extend sixteen feet, while the trunk is only one foot from the ground to the lowest limbs. I took off *seven-eighths* of the fruit from this tree, by count, and it matured two and a half bushels of the finest plums ever seen in our market, not excepting the California fruits. The fruit of the entire tree would average six inches in circumference, and some of them measured six and three-quarter inches. The fruit was all No. 1, and I picked every plum while standing on the ground.

Had I allowed all the fruit to remain on the tree I would not have had any more bushels, and it would not have brought me one half as much, and the tree would certainly have been ruined. It requires *good judgment, care and time* to thin fruit properly, but I believe no work in the orchard will pay better.

The direct gains derived from thinning are *increased size, better quality*, and consequently an enhanced market value of

the fruit. By decreasing the number of specimens on a tree we decrease the number of seeds, and while we will get as many bushels of fruit the fewer number of seeds to mature would delay the exhaustion of the soil and greatly prolong the life of the tree.

## GRAPE GROWING IN VERMONT.

By Chas. A. Hinsdill, of North Bennington, Read at the Middlebury Meeting.

Grapes can be grown successfully in all parts of Vermont. Earliness is of first importance here, and every planter must keep this fact in mind from the time he obtains the vines until the grapes are picked.

Varieties which ripen before Concord should be chosen, Concord may be the grape for the million but it is not the grape for Vermont. My choice of six varieties would be Moore's Early, Green Mountain, Delaware, Warden, Diamond and Wyoming Red. Moore's Early is the best, grape for general planting in this state.

Plant the vines in the warmest and sunniest place you have, the soil must not be wet; sandy or gravelly soils are best but grapes can be grown in any soil provided it is well drained and in good condition.

When planting do not place manure or other fertilizer in contact with or even very near the roots.

If the soil is poor, apply the fertilizer on the surface after the vines are planted. Manure, chip dust, rotten straw or similar material spread on the ground about the plant will serve as a mulch and may save the life of a newly planted vine if the season is dry. After the vines commence bearing do not use stable manure as it will cause too rank a growth of vine and the fruit will not ripen well. Apply fertilizers which are very rich in phosphoric acid. I believe this will cause the fruit to ripen much earlier. However, I have not tried it nor have I seen this point spoken of in any work on grape culture that I have read,

and none of the experiment stations so far as I know have investigated the subject. Every farmer will tell you that "phosphate" will make corn ripen earlier; who can say that it would not affect the grape in the same way? I am confident that it would, and should be pleased to see the Vermont station experiment with different formulas on the grape.

The pruning of the vines is not generally understood in Vermont and is often neglected. This neglect is probably responsible for more failures than any other one cause. There are several systems of pruning and training each of which has its merits. The renewal system is practiced by some Vermonters with success. By it nearly all the old wood is cut away every year leaving on young vines two and on older ones three or four canes of the current year's growth that started nearest the crown of the vine, from spurs or canes which grew the previous year. Cut these canes back to three or four feet in length each according to the growth of the vine, tying them fan shape to the trellis the next spring. In trimming also leave near the crown two or three spurs of two buds each, from which to grow canes for the following year's fruiting.

The spur system in some of its various forms is the one usually followed in this section. By this system the vine is established on the trellis and each year thereafter the season's growth is cut back to one or two buds.

In many gardens there are old vines that have not been pruned for years and the owner still neglects them because he does not know how to proceed, and no wonder, for it is next to impossible to get a satisfactory looking vine out of such a tangled mass of wood as is often found. Perhaps the best way is to cut the vine all away and start new. However, few can bring themselves to such heroic treatment, and I advise those who cannot to cut away just as much of the vine as their feelings will allow, and each year thereafter cut away more of the old vine until the whole has been renewed, when any of the regular systems can be adopted.

What is called summer pruning is practiced by most careful growers and is considered of great benefit. Their practice is to pinch off the ends of the shoots four or five leaves beyond the last cluster of fruit. All useless shoots should be rubbed off as soon as the bud starts and no suckers should be allowed to grow from the root.

The winter pruning may be done at any time from November to March, but the best plan is to do the work in November and then lay the vine down and cover it with straw or earth, allowing it to remain covered until the buds begin to swell in the spring. This protection is very beneficial to the vines, even those that are entirely hardy are improved by it. Lay your vines down even if you do not cover them. Very few grapes are grown for market in Vermont, but I think that fruit growers whose fruit is retailed from their own wagons could make money by raising choice grapes for their customers. A number of varieties should be raised, and "quality, not quantity" should be the motto.

# BEE KEEPING.

By Thaddeus L. Kinney, Jr., Read at the Grand Isle Meeting.

Many people seem to have a prejudice against the honey bee. Farmers who ought to grow all the honey they need for their own use actually buy it at the store. Some of them think they have n't time to fuss with the bees, and others are afraid of these little insects. It is not the sting of a honey bee that disturbs people so much as it is the buzzing sound they make in their flight. This is so because people always get their fright and often run before they are stung at all. People are often frightened by the lightning's terrible work, but more frightened by the thunder's roar.

Then let us not be disturbed by these nervous notions, for there is great satisfaction in the farmer's household from the product of the apiary in that sweetest of sweets which may be enjoyed by us all almost without cost or price. But some will say that honey is too low when it sells at 10 or 12 cents per pound. I am out of the business, but remember that when farmers sell they sell at wholesale and pay the freight, but when they buy they buy at retail and pay the freight. So that if we sell at 10 or 12 cents we buy at 14 to 16 cents.

In this cold climate in all kinds of stock raising feed is the great item, but the honey bee gathers its own supply. We do not have to sow or plant especial crops for its use, but it gathers from the crops we have grown for our stock or for market and yet they do not gather that which we would have harvested. We often hear bees spoken of as making honey, but this is not correct, as they simply gather the product.

To handle bees one needs to study their nature that he may know their likes and dislikes; one needs to teach his bees and be taught by them. Light colored clothing is best to wear while working about the bee yard. A black wool hat and a black coat will prove unpleasant to the bees, and much more so to the wearer. The honey bee is a very industrious little being and will risk its life any time for rich stores. It is also a very sensitive being and will risk its life any time to protect itself and mates against improprieties and ill manners. Then wear a light straw hat and handle the bees in shirtsleeves, smoke the bees lightly and handle them with care and some of the secrets are learned.

A plain, unpatented frame hive is the best for a farmer. Foundation starters with one pound sections are necessities; equipped with a wire screen veil, thin gloves with wraps around the wrists and a good smoker, one is prepared not for battle but for good work.

## JAPANESE PLUMS IN VERMONT.

By J. E. Crane, of Middlebury, Read at the Middlebury Meeting.

The introduction of Japanese or Oriental plums during the last twenty-five years has been a very important event in the horticultural history of our country. Exaggerated accounts and illustrations in nursery catalogues caused disappointment at first, for it did not seem possible to produce such magnificent plums in our cold climate. However, they have slowly come into cultivation; many of them have proved very interesting and some of great value, so far as we may judge at this time.

The questions we first ask in regard to this new class of fruit are: Will they withstand the black-knot? Are they curculio-proof? Will they endure our cold winters? Will they rot on the trees?

As I have never seen any black-knot on this class of plums, there is reason to believe that they are much less liable to attacks than the common plum; and this, I understand is the experience of plum-growers in western New York, where they have been planted quite extensively.

It has been represented by some nurserymen that some of these plums were curculio-proof, but I have not found them so, and yet they appear to suffer much less than do the common or European plums. Nearly all Oriental plums have a tough skin which the curculio finds more difficult to puncture than that of the thinner skinned varieties. And when he does puncture them the pulp does not seem to be healthful food for the young larvæ, and but few of the eggs laid seem to mature. In 1896 when there were few plums of other kinds, the curculios concentrated their efforts on some Japanese plums in my garden, and I have counted

twenty-five or more curculio marks upon a single plum, and still it hung to the tree and matured, although somewhat out of shape and not of much value.

The greatest difficulty I have in cultivating the European plum is the plum-rot. Some varieties are almost destroyed by it, while nearly all are more or less injured. With me, this disease is far worse than either curculio or black-knot. The Japanese plums so far with me have been almost exempt from it.

They vary in hardiness as all other fruits do. The fruit buds seem to be capable of enduring more cold than the European plums, side by side.

The quality of Oriental plums varies with different varieties. The best of them we may place side by side with the best of European plums in flavor, while their ability to keep from one to three weeks after they are picked adds very much to their value.

I will speak of some varieties that I have fruited in the order of their ripening. First is the Red June, which I received under the name of Shiro Sonomo. This variety begins to ripen with me about August 1, and although rather acid, its great beauty (being the brightest cherry red, some say vermilion) its earliness and productiveness make it a great favorite. With one exception, I find the fruit buds of this variety will endure more cold than any European plum in my collection, while the size of the fruit so far has been even larger than represented. There are other varieties said to be earlier but of small size and inferior quality. I have fruited none of them.

The Abundance comes in next, before all the Red Junes are gone, and is of better quality (about with the Lombard) very handsome, a light cherry in color, or yellow on one side and red on the other, much like the most brilliant crab-apples. It is immensely productive, and when not allowed to overbear, of good size or even large,—some specimens measuring more than six inches in circumference. Before the Abundance is gone the Burbank begins to ripen, and while the fruit with me has not been quite so large as Abundance, the quality has seemed even

better. This variety is a most prolific bearer, handsome, and one of the best.

Following the Burbank comes the Chabot, which I received under the name of Bailey. It is also known as the Chase and Yellow Japan. This is one of the best varieties I have fruited. On young trees not allowed to overbear, it is of good size, or even large, and of the best quality. When ripe or ready to pick, the plums are in color a yellow or orange and pink, or light cherry, and gradually change to a bright red, and later to a dark cherry. They should be picked while yet a little hard, when in a few days they will become soft, juicy and delicious. They will keep for two weeks after picking, and I have kept them three weeks or more.

The Satsuma I have fruited, but have found both wood and fruit buds too tender for our severe winters. It is, however, very interesting, the flesh of the fruit being a full blood red.

I have also fruited the *Prunus simoni*, which appears to be a true Japanese plum, notwithstanding its upright growth and peach-shaped leaves. It is to be regretted that this variety is also a little tender, and what is worse, a very shy bearer, for the fruit is so interesting as to pay for the room it takes. Of the shape, color and size of a red tomato, two inches in diameter, it changes to a darker shade, almost a chestnut before it begins to decay.

I have received from Mr. Normand of Louisiana the Mikado, White Kelsey and Normand's Japan. The Mikado, from which I expected great things, was so tender that every branch and twig was killed the first winter. The White Kelsey appears to be hardy both in fruit bud and wood, as it blossomed last spring after the hard winter and set some fruit, but the fruit dropped. Mr. Normand says this variety is the exact counterpart of the Kelsey, so popular in the South, except in color, which is white. Norman's Japan appears to be the same as the Georgeson. It is a golden-yellow plum of fine quality, and as hardy as any of this class of plums, as it blossomed with me last

spring, but for some reason the fruit did not mature. I have also the Berckmans, similar to Abundance, and the Hale, which are promising, but neither has bloomed yet.

All varieties of Oriental plums that I have fruited vary much more in size, shape and color than the common plums. Most of them have a tougher skin, which seems to protect them from the curculio and plum rot in a large measure. The trees also resist the black-knot better than the European plum. Some varieties are quite apt to overbear. The Burbank appears to be fine for canning. Most varieties of Japanese plums come early into bearing, which with their bright colors, pleasant flavor, delightful aroma and long-keeping qualities, will, I believe, make them popular wherever they can be grown.

From my own experience, and what I can learn from other sources, the Red June, Abundance, Burbank and Chabot or Bailey are the best for our climate, or as so far fully tested, and give an almost constant succession of fruit from the last of July until the middle or last of September.

# ORCHARDING IN ORLEANS COUNTY.

By Dr. T. H. Hoskins, Read at The Horticultural Meeting in Burlington.

In 1866, when I made my first visit to Northeastern Vermont, I was highly pleased with the appearance of the country and the soil—the latter recalling to me that of Kentucky about Louisville, where I had passed twelve years of my earlier life, after my majority. It seems to me to be an ideal fruit region; but when I mentioned this I was told, to my great surprise, that attempts at orcharding there had proved almost an entire failure because of the severe winters. Two varieties of apples, one the well known Fameuse, and the other a fall apple called Donegan's Sweet, from the name of its introducer, were grown to some extent in specially protected places by a few individuals; and the equally well known Peach Apple of Montreal, was being sold quite widely by tree peddlers. But the general belief was that all apple trees, even the hardiest, must be of short existence, and little profit, in the valley of Lake Memphremagog.

Ill health having obliged me to forego the practice of my profession, and having been all my life fond of horticulture, I began, first in my garden in Newport, and, soon after, on a ten-acre farm which I had purchased to try such varieties and species of tree fruits as were generally recommended in works of horticulture for the colder climates of Northern New England—of which I was a native. My boyhood was passed in the Kennebec valley of Maine, and I may truly claim to have been born and brought up among orchards and gardens, my taste for which increased with my growth.

The first varieties which I planted were the Russian Tetofsky, Oldenburgh and Alexander; and as time passed I found these to be far more hardy against cold than any of the above named; except the "Peach Apple," which has all the character of the Russians, and is, I feel sure, a native of Northern Europe, introduced into Canada from France.

Before I had advanced very far in my experiments two events took place which had a most stimulating effect,—the production of the Wealthy Apple in Minnesota, and the introduction, by our American Department of Agriculture of an extensive list of Russian apples, which were distributed widely from Washington. Some dozen or more varieties fell to my lot; and amongst these was the Yellow Transparent, which I distributed widely and which has now become popular even where its hardiness is not essential. Another very useful variety, Prolific Sweeting, has also proved extremely useful and widely popular; being, as I think, one of the finest summer sweet apples in existence.

The government importation of Russians had demonstrated to us the existence in Europe of just such a class of apples as was required for Northeastern Vermont, and the cold North generally. But the absence of long-keeping apples among them stimulated a continued search among pomologists and orchardists for fruit which could be relied on to furnish a winter supply of this class of fruit. Search in my own neighborhood brought to light the Magog Red Streak and Scott's Winter. The first named of these is not without value, as a large, handsome and good apple; but Scott's Winter, though a smaller fruit, is so productive, and so entirely reliable a keeper, even into the latter months of spring that the Red Streak has comparatively dropped out of notice. Scott's Winter is, I am told, now a standard market apple even so far west as Oregon; and is extensively grown all over our northern tier of states and in the Dominion of Canada.

The facts above stated so encouraged research, without fully supplying the general wants of our orchardists, that another pomological search through Russia was demanded; and some ten

ten years since a summer visit to the great orchard regions of Russia was planned and carried out by Prof. J. L. Budd of the Iowa Agricultural College, and Mr. Charles Gibb of Canada. The whole of one season was given to this work; and the results are now being realized all over the cold North in the first fruitage of a large list of Russian apples, pears, plums and cherries. The hardiness of these various fruits has been well tested in the time required to bring them to fruitage; and that is no longer in doubt. But their qualities, compared with our older stock, is a matter of the deepest interest to the fruit growers of the cold North. So far as one or two seasons suffice for this purpose, I think we have much to encourage us. These young Russian fruit trees have proved themselves quite as thoroughly "Iron-Clad" as the apples of earlier importations. As a whole, I think we have at least much reason to be pleased with what we have got; but its chief value is not to be judged merely by our immediate possessions. From these Russian pears, plums, cherries, (and as well also as our apples) we have the same chance to grow valuable seedlings as our forefathers had to produce the large list of choice seedlings which are giving us a full equality with the best regions anywhere. These Russian seedlings are good, even if they be not classible with our absolutely "best." We have the same free chance as our earlier importations to produce and reproduce with our own hands a series of pure blooded and cross blooded progeny. We have the material for a hundred years of industrious manipulation of these iron-clad gifts from the gardens and orchards of Northeastern Europe. There is no end to the variations we may produce in building up our great fruit interests with the aid of these Russians which have given us such material to work upon. Have the fruit growers of our cold North, from the Atlantic to the Pacific, any less ability in these directions than our fathers and grandfathers? I trow not.

# STATISTICAL REPORT OF FARM SALES AND NEW INDUSTRIES IN VERMONT, IN 1897.

By F. C. WILLIAMS, Assistant Secretary.

Reports received from the town clerks of one hundred and fifty-seven towns in the State, show that there have been sold in these towns between January 1, 1897, and January 1, 1898, 1,535 farms; 197 of these farms were not occupied at the time of sale. The same towns in 1896, reported sales of 1,112 farms of which 135 were not occupied. The increased number of sales is a gratifying indication even though prices have not advanced. The farms sold are distributed as follows, viz:

| | | | |
|---|---|---|---|
| Addison County, | 99 | Unoccupied | 10 |
| Bennington County, | 65 | " | 12 |
| Caledonia County, | 120 | " | 21 |
| Chittenden County, | 86 | " | 0 |
| Essex County, | 68 | " | 7 |
| Franklin County, | 80 | " | 0 |
| Grand Isle County, | 20 | " | 0 |
| Lamoille County, | 79 | " | 5 |
| Orange County, | 143 | " | 16 |
| Orleans County, | 162 | " | 18 |
| Rutland County, | 69 | " | 5 |
| Washington County, | 114 | " | 11 |
| Windham County, | 145 | " | 35 |
| Windsor Conuty, | 285 | " | 57 |
| | 1535 | " | 197 |

## NEW INDUSTRIES.

The reports received show that during 1897, $81,700 have been invested in new manufacturing enterprises in the above 157 towns, giving employment to 198 persons, which is the smallest

amount invested in such new industries in any year since these statistics have been taken.

These enterprises are distributed among the Counties as follows:

| County. | Capital. | Employees. |
|---|---|---|
| Addison, | $20,000 | 58 |
| Bennington, | 4,500 | 15 |
| Chittenden, | 2,000 | 10 |
| Caledonia, | 3,000 | 2 |
| Essex, | 6,000 | 12 |
| Lamoille, | 1,500 | 6 |
| Orange, | 1,000 | 8 |
| Orleans, | 12,500 | 25 |
| Rutland, | 11,200 | 35 |
| Washington, | 6,700 | 9 |
| Windham,—Cănning Factory in Brattleboro. | | |
| Windsor, | 13,300 | 18 |
| | $81,700 | 198 |

A list of different industries follows:

| | |
|---|---|
| Condensed Milk Factory | Bristol. |
| Novelty Company | " |
| Lumber Mill | Hancock. |
| Creamery | Starksboro. |
| Butter and Cheese Factory | Shaftsbury. |
| Water Closet Manufacturing Company | Winhall. |
| Creamery | Sheffield. |
| Printing Company | Essex. |
| Grist Mill | Lunenburgh. |
| Saw Mill | Victory. |
| Planing Mill | Belvidere. |
| Spindles and Bobbins | West Fairlee. |
| Co-operative Creamery | Coventry. |
| Creamery | Craftsbury. |
| Co-operative Creamery | Glover. |
| Creamery | Greensboro. |
| Creamery | Newport Center. |
| Butter Boxes | Lowell. |
| Slate Quarry | Benson. |
| Box Factory | Pittsford. |

| | |
|---|---|
| Granite Tools | East Montpelier. |
| Creamery | " " |
| Co-operative Creamery | Waitsfield. |
| Corn Canning Factory | Brattleboro. |
| Creamery | Barnard. |
| Two Saw Mills | " |
| Two Chair Stock Mills | Chester. |
| Electric Light Plant | Rochester. |

## CENSUS OF LIVE STOCK OF VERMONT, APRIL 1, 1897.

At the organization of the Board in December, 1896, it was decided to take the census of live stock in the State and collect statistics showing the amount of grain and feeds of all kinds imported into the State. The work has been rather difficult because of no way of getting these facts, except through the courtesy and assistance of those who had charge of the figures. In a large number of cases the Listers were very anxious to assist and when they were indifferent the Town Clerk usually was willing to do the work. In some cases citizens in the town who were not at the time officers in charge of the records, have given great assistance. To all who have so freely given time and labor to make these tables as complete as they are, I wish to return my sincere thanks, trusting that the information which they will get by studying them will be of some value. I have compared the total number of each kind of live stock in the State, April 1, 1897, with the number shown by the United States Census of 1890, making allowance in each as best I could for missing towns. The United States Census shows the amount by Counties only, and only the animals on farms. My totals show the animals in each town as returned to the listers. As it is probable, and in fact certain that in a few large towns the live stock does not all appear on the inventories, the two sets of figures, viz: United States Census and mine can be fairly compared I think.

## CENSUS OF LIVE STOCK.

| ADDISON COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock. | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts.. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Addison | 1,113 | $22,493 | 169 | $2,758 | 496 | $ 4,495 | 1,693 | $3,690 | 305 | $1,384 | 641 | $19,418 | 20 | $ 240 |
| Bridport | 1,109 | 26,738 | | | 827 | 10,445 | 3,062 | 7,933 | 315 | 1,722 | 769 | 27,625 | | |
| Bristol | 953 | 19,600 | | | 300 | 3,000 | 402 | 1,200 | 354 | 1,416 | 543 | 21,720 | | |
| Cornwall | | | | | | | | | | | | | | |
| Ferrisburgh | 1,990 | 41,790 | 4 | 400 | 991 | 10,901 | 1,179 | 2,358 | 603 | 2,412 | 957 | 38,280 | | |
| Goshen | 216 | 3,992 | 20 | 789 | 208 | 1,365 | 328 | 612 | 61 | 240 | 114 | 3,924 | 4 | 55 |
| Granville | 434 | 8,221 | 20 | 665 | 285 | 2,617 | 288 | 764 | 101 | 464 | 265 | 8,225 | | |
| Hancock | 184 | 3,680 | 14 | 700 | 117 | 936 | 428 | 856 | 35 | 140 | 120 | 3,600 | 12 | 120 |
| Lincoln | 1,059 | 16,668 | 8 | 160 | 661 | 5,445 | 379 | 744 | 320 | 1,235 | 425 | 12,250 | | |
| Leicester | 372 | 7,997 | 6 | 275 | 291 | 3,034 | 530 | 1,218 | 137 | 664 | 258 | 8,405 | | |
| Middlebury | 1,007 | 20,579 | 2 | 60 | 547 | 5,452 | 1,388 | 2,744 | 271 | 1,121 | 958 | 40,915 | | |
| Monkton | 1,309 | 31,071 | | | 430 | 3,500 | 425 | 1,208 | 349 | 1,755 | 388 | 17,589 | | |
| New Haven | | | | | | | | | | | | | | |
| Orwell | 2,245 | 50,179 | | | 1,190 | 15,683 | 2,413 | 5,562 | | | 1,136 | 39,521 | | |
| Panton | 573 | 11,276 | | | 272 | 2,425 | 434 | 777 | 143 | 614 | 267 | 8,919 | | |
| Ripton | 374 | 7,771 | 10 | 310 | 173 | 2,042 | 243 | 508 | 64 | 195 | 286 | 6,895 | | |
| Salisbury | 646 | 13,281 | 2 | 125 | 226 | 1,974 | 713 | 1,835 | 141 | 617 | 353 | 12,445 | | |
| Shoreham | 1,191 | 26,372 | 60 | 1,411 | 507 | 5,867 | 3,445 | 10,793 | 355 | 1,342 | 643 | 24,955 | 67 | 2,180 |
| Starksboro | 1,357 | 28,497 | 10 | 400 | 511 | 5,621 | 466 | 1,398 | 374 | 1,496 | 460 | 18,400 | | |
| Vergennes | 172 | 2,634 | | | 24 | 214 | 13 | 35 | 49 | 245 | | | 5 | 55 |
| Waltham | 392 | 5,401 | | | 144 | 1,079 | 392 | 889 | 160 | 611 | 238 | 8,673 | | |
| Weybridge | 430 | 10,215 | | | 198 | 2,000 | 439 | 1,154 | 74 | 375 | 138 | 6,850 | | |
| Whiting | | | | | | | | | | | | | | |
| Total | 17,146 | $358,455 | 325 | $8,053 | 8,398 | $88,095 | 18,110 | $46,278 | 4,211 | $18,048 | 8,954 | $328,609 | 153 | $2,650 |
| U. S. Census, 1890 | 18,991 | | 834 | | 12,382 | | 47,686 | | 6,646 | | 9,849 | | | |

## CENSUS OF LIVE STOCK.

| BENNINGTON COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock. | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arlington | 560 | $11,534 | 6 | $ 220 | 195 | $1,649 | 1,647 | $2,261 | 161 | $ .772 | 407 | $14,115 | | |
| Bennington | | | | | | | | | | | | | | |
| Dorset | 1,250 | 30,000 | | | 575 | 6,325 | 140 | 350 | 250 | 1,250 | 350 | 14,000 | | |
| Glastenbury | 20 | 340 | | | 1 | 6 | 4 | 8 | 2 | 6 | 16 | 390 | 5 | $ 105 |
| Landgrove | 150 | 3,315 | 4 | 130 | 95 | 910 | 145 | 394 | 32 | 156 | 100 | 3,645 | 3 | 85 |
| Manchester | 849 | 19,539 | 4 | 125 | 303 | 3,446 | 660 | 1,323 | 221 | 1,180 | 432 | 22,395 | 5 | 190 |
| Peru | 325 | 7,342 | | | 175 | 2,282 | 140 | 586 | 81 | 398 | 169 | 5,945 | | |
| Pownal | 966 | 20,000 | | | 280 | 2,800 | 2,577 | 4,500 | 435 | 3,000 | 529 | 24,000 | | |
| Readsboro | 339 | 4,782 | 44 | 1,603 | 133 | 1,112 | 364 | 771 | 65 | 325 | 201 | 8,168 | | |
| Rupert | | | | | | | | | | | | | | |
| Sandgate | 364 | 7,122 | 3 | 135 | 142 | 1,228 | 1,703 | 3,880 | 180 | 760 | 240 | 6,725 | 14 | 340 |
| Searsburgh | 34 | 737 | 6 | 205 | 25 | 185 | 14 | 38 | 24 | 106 | 87 | 3,125 | | |
| Shaftsbury | 733 | 14,885 | 4 | 150 | 445 | 4,384 | 2,655 | 5,566 | 256 | 1,053 | 503 | 19,433 | 16 | 445 |
| Stamford | 462 | 8,967 | 12 | 305 | 171 | 1,345 | 106 | 200 | 67 | 354 | 214 | 7,937 | | |
| Sunderland | 176 | 4,051 | 11 | 385 | 96 | 644 | 459 | 467 | 66 | 252 | 165 | 5,216 | 9 | 200 |
| Winhall | 260 | 6,052 | 40 | 1,255 | 180 | 1,952 | 218 | 777 | 54 | 333 | 177 | 6,565 | | |
| Woodford | 68 | 1,520 | 2 | 100 | 39 | 370 | 27 | 49 | 32 | 149 | 98 | 4,585 | | |
| Total | 6,556 | $140,186 | 136 | $4,613 | 2,855 | $28,638 | 10,859 | $21,170 | 1,926 | $10,094 | 3,688 | $146,244 | 52 | $1,365 |
| U. S. Census, 1890 | 9,459 | | 729 | | 6,954 | | 27,620 | | 4,387 | | 4,302 | | | |

## CENSUS OF LIVE STOCK.

| CALEDONIA COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barnet | 2,071 | $53,037 | ........ | ........ | 905 | $9,712 | 388 | $ 1,581 | 712 | $ 4,149 | 700 | $ 31,079 | ........ | ........ |
| Burke | 976 | 17,860 | 24 | $ 1,157 | 367 | 3,056 | 672 | 1,613 | 194 | 1,027 | 551 | 24,145 | ........ | ........ |
| Danville | 1,807 | 40,737 | 28 | 885 | 763 | 6,485 | 569 | 1,138 | 525 | 3,150 | 843 | 35,406 | 39 | $ 1,000 |
| Groton | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ |
| Hardwick | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ |
| Kirby | 411 | 10,879 | 14 | 816 | 309 | 3,383 | 451 | 1,352 | 152 | 874 | 249 | 11,603 | 77 | 2,700 |
| Lyndon | 1,172 | 25,110 | 36 | 1,805 | 512 | 5,495 | 1,253 | 3,792 | 449 | 2,531 | 910 | 35,423 | ........ | ........ |
| Newark | 508 | 11,642 | 8 | 270 | 233 | 2,085 | 450 | 1,054 | 123 | 721 | 148 | 6,052 | ........ | ........ |
| Peacham | 1,091 | 21,937 | 6 | 212 | 581 | 4,722 | 207 | 816 | 397 | 2,223 | 310 | 14,359 | ........ | ........ |
| Ryegate | 2,060 | 46,473 | 7 | 337 | 780 | 6,779 | 358 | 1,024 | 608 | 3,709 | 479 | 19,212 | ........ | ........ |
| Sheffield | 821 | 17,870 | 18 | 625 | 405 | 3,497 | 402 | 1,077 | 182 | 969 | 253 | 14,850 | 84 | 1,680 |
| St. Johnsbury | 1,390 | 31,278 | 14 | 500 | 578 | 8,000 | 565 | 2,147 | 549 | 2,752 | 1,144 | 46,860 | ........ | ........ |
| Stannard | 220 | 4,840 | 4 | 120 | 116 | 987 | 199 | 492 | 50 | 189 | 113 | 3,560 | 8 | 170 |
| Sutton | 625 | 13,828 | 10 | 425 | 249 | 2,481 | 485 | 1,314 | 178 | 1,083 | 337 | 12,925 | ........ | ........ |
| Walden | 997 | 23,474 | 11 | 512 | 371 | 3,184 | 295 | 881 | 213 | 1,221 | 306 | 12,564 | ........ | ........ |
| Waterford | 1,095 | 22,969 | 32 | 1,632 | 701 | 8,089 | 448 | 1,580 | 344 | 1,968 | 362 | 14,668 | 46 | 1,426 |
| Wheelock | 489 | 10,073 | 14 | 565 | 213 | 2,051 | 609 | 1,783 | 117 | 728 | 252 | 10,190 | 27 | 700 |
| Total | 15,733 | $352,007 | 226 | $9,861 | 7,083 | $70,006 | 7,351 | $21,644 | 4,793 | $27,294 | 6,957 | $292,896 | 281 | $7,676 |
| U. S. Census 1890 | 15,456 | | 1,781 | | 10,141 | | 20,146 | | 7,442 | | 6,848 | | | |

## CENSUS OF LIVE STOCK.

| CHITTENDEN COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bolton | 521 | $11,096 | 42 | $1,365 | 181 | $1,666 | 78 | $174 | 155 | $634 | 165 | $6,080 | | |
| Burlington | | | | | | | | | | | | | | |
| Charlotte | 2,243 | 46,123 | | | 657 | 6,188 | 1,053 | 2,506 | 632 | 3,592 | 691 | 29,019 | | |
| Colchester | 1,442 | 33,703 | 13 | 147 | 417 | 4,086 | 514 | 1,120 | 538 | 3,061 | 711 | 30,362 | | |
| Essex | 1,891 | 35,981 | 12 | 475 | 630 | 5,071 | 205 | 610 | 553 | 2,706 | 670 | 23,233 | 27 | $685 |
| Hinesburgh | 2,026 | 40,520 | | | 544 | 4,352 | 454 | 1,362 | 691 | 3,450 | 464 | 23,200 | | |
| Huntington | | | | | | | | | | | | | | |
| Jericho | 2,061 | 46,849 | 8 | 375 | 575 | 5,099 | 69 | 461 | 591 | 2,475 | 504 | 18,715 | 1 | 10 |
| Milton | | | | | | | | | | | | | | |
| Richmond | 1,841 | 38,931 | 6 | 225 | 627 | 3,583 | 233 | 496 | 396 | 1,279 | 325 | 10,660 | 29 | 430 |
| Shelburne | 1,018 | 25,752 | | | 318 | 3,003 | 467 | 1,710 | 391 | 2,002 | 586 | 31,262 | 10 | 390 |
| South Burlington | 698 | 16,632 | | | 238 | 2,140 | 164 | 425 | 528 | 2,401 | 410 | 14,850 | | |
| St. George | 182 | 4,451 | | | 46 | 481 | | | 63 | 285 | 51 | 2,325 | 5 | 110 |
| Underhill | 1,471 | 29,420 | 20 | 600 | 598 | 5,382 | 296 | 888 | 421 | 1,684 | 396 | 15,840 | | |
| Westford | 2,001 | 43,834 | 20 | 670 | 588 | 6,120 | 198 | 569 | 497 | 2,350 | 457 | 17,636 | | |
| Williston | 2,123 | 50,222 | 4 | 115 | 562 | 4,934 | 271 | 755 | 493 | 2,856 | 516 | 19,480 | | |
| Total | 19,518 | $423,514 | 125 | $3,972 | 5,981 | $52,105 | 4,002 | $11,076 | 5,949 | $28,775 | 5,946 | $242,663 | 72 | $1,625 |
| U. S. Census 1890 | 24,054 | | 646 | | 9,435 | | 8,804 | | 8,549 | | 6,596 | | | |

South Burlington, two Mules, $75.00. Census, $63.00.

CENSUS OF LIVE STOCK.

| ESSEX COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock. | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts.. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bloomfield ........... | 211 | $ 3,577 | 4 | $ 115 | 151 | $1,208 | 281 | $ 475 | 97 | $ 426 | 159 | $ 4,487 | 1 | $ 15 |
| Brighton.............. | 523 | 10,266 | 7 | 190 | 293 | 2,866 | 397 | 1,131 | 253 | 1,100 | 402 | 16,055 | ........ | .......... |
| Brunswick ........... | 85 | 1,488 | ...... .. | ........... | 107 | 1,148 | 163 | 405 | 25 | 167 | ........ | ........... | ........ | .......... |
| Canaan ................ | 584 | 10,016 | 2 | 75 | 448 | 5,053 | 662 | 1,575 | 277 | 1,225 | 446 | 17,850 | ........ | .......... |
| Concord............... | 805 | 14,314 | 65 | 1,975 | 481 | 3,159 | 484 | 1,580 | 230 | 1,140 | 555 | 15,277 | ........ | .......... |
| East Haven .......... | 119 | 2,614 | 6 | 213 | 57 | 567 | 153 | 439 | 39 | 180 | 82 | 3,185 | 8 | 179 |
| Guildhall ............. | 307 | 5,770 | 12 | 330 | 154 | 1,364 | 259 | 700 | 104 | 499 | 303 | 10,742 | ........ | .......... |
| Lemington ........... | 192 | 2,957 | 6 | 245 | 191 | 1,807 | 290 | 625 | 86 | 329 | 176 | 5,070 | ........ | .......... |
| Lunenburgh ......... | 1,040 | 22,804 | 24 | 860 | 568 | 5,524 | 793 | 2,123 | 249 | 979 | 393 | 13,572 | ........ | .......... |
| Maidstone............ | 148 | 2,554 | 12 | 390 | 170 | 1,148 | 232 | 524 | 55 | 188 | 103 | 3,335 | 9 | 170 |
| Norton................. | 107 | 1,719 | 4 | 70 | 72 | 354 | 88 | 248 | 92 | 500 | 175 | 5,770 | 29 | 875 |
| Victory ................ | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... |
| Total............. | 4,121 | $78,079 | 142 | $4,463 | 2,692 | $24,198 | 3,802 | $9,825 | 1,507 | $6,733 | 2,794 | $95,343 | 47 | $1,239 |
| U. S. Census, 1890.. | 3,781 | | 949 | | 4,616 | | 6,214 | | 1,971 | | 2,466 | | | |

## CENSUS OF LIVE STOCK.

| FRANKLIN COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bakersfield | 1,551 | $21,416 | 12 | $ 305 | 572 | 4,863 | 323 | $1,363 | 264 | $1,236 | 437 | $13,917 | | |
| Berkshire | | | | | | | | | | | | | | |
| Enosburgh | | | | | | | | | | | | | | |
| Fairfax | 1,809 | 31,983 | 12 | 460 | 555 | 4,429 | 185 | 407 | 505 | 2,271 | 375 | 11,926 | | |
| Fairfield | | | | | | | | | | | | | | |
| Fletcher | 1,448 | 25,045 | 30 | 960 | 390 | 3,047 | 184 | 480 | 338 | 1,490 | 330 | 9,960 | | |
| Franklin | 2,524 | 48,838 | 2 | 75 | 629 | 4,835 | 277 | 679 | 576 | 2,949 | 521 | 21,875 | | |
| Georgia | 2,075 | 23,225 | 4 | 250 | 543 | 5,430 | 1,007 | 4,028 | 608 | 2,128 | 632 | 31,600 | | |
| Highgate | 2,147 | 39,431 | | | 1,805 | 4,251 | 314 | 724 | 658 | 3,151 | 746 | 30,232 | | |
| Montgomery | | | | | | | | | | | | | | |
| Richford | 1,428 | 27,687 | 4 | 150 | 300 | 2,892 | 198 | 764 | 268 | 1,262 | 456 | 17,328 | 24 | $ 765 |
| Sheldon | 2,606 | 48,546 | | | 572 | 4,663 | 175 | 505 | 456 | 2,219 | 487 | 16,680 | | |
| St. Albans | 1,776 | 35,993 | 28 | 1,504 | 437 | 4,255 | 428 | 1,211 | 786 | 3,364 | 647 | 24,542 | 52 | 1,414 |
| St. Albans City | 120 | 2,618 | | | 12 | 94 | | | 25 | 167 | 434 | 21,545 | 5 | 155 |
| Swanton | | | | | | | | | | | | | | |
| Total | 17,484 | $304,782 | 92 | $3,704 | 5,815 | $38,759 | 3,091 | $10,161 | 4,484 | $19,237 | 5,065 | $199,605 | 81 | $2,334 |
| U. S. Census 1890 | 32,038 | | 886 | | 10,373 | | 9,016 | | 9,102 | | 7,141 | | | |

## CENSUS OF LIVE STOCK.

| GRAND ISLE COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock. | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alburgh | 789 | $14,592 | ........ | ........ | 439 | $3,700 | 405 | $1,186 | 211 | $ 830 | 453 | $17,580 | 56 | $1,155 |
| Grand Isle | 835 | 14,310 | ........ | ........ | 244 | 1,561 | 783 | 1,409 | 310 | 1,181 | 352 | 8,163 | ........ | ........ |
| Isle LaMotte | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ |
| North Hero | 363 | 6,643 | 2 | $80 | 371 | 2,997 | 702 | 1,010 | 119 | 802 | 318 | 9,419 | 1 | 15 |
| South Hero | 566 | 10,592 | ........ | ........ | 223 | 1,638 | 362 | 708 | 256 | 1,244 | 258 | 10,642 | 37 | 925 |
| Total | 2,553 | $46,137 | 2 | $80 | 1,277 | $9,896 | 2,252 | $4,313 | 896 | $4,057 | 1,381 | $45,804 | 94 | $2,095 |
| U. S. Census, 1890 | 2,382 | | 33 | | 1,556 | | 5,824 | | 1,682 | | 2,054 | | | |
| **LAMOILLE COUNTY.** | | | | | | | | | | | | | | |
| Belvidere | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ |
| Cambridge | 2,252 | $39,211 | 48 | $1,170 | 850 | $5,879 | 115 | $ 403 | 600 | $2,515 | 612 | $21,504 | ........ | ........ |
| Eden | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ |
| Elmore | 792 | 12,891 | 10 | 250 | 208 | 1,494 | 359 | 919 | 293 | 825 | 250 | 8,335 | ........ | ........ |
| Hyde Park | 1,102 | 21,077 | 20 | 665 | 475 | 4,190 | 1,336 | 3,454 | 321 | 1,608 | 637 | 26,235 | ........ | ........ |
| Johnson | 1,250 | 22,500 | 4 | 120 | 427 | 2,976 | 583 | 1,166 | 373 | 1,865 | 495 | 16,345 | ........ | ........ |
| Morristown | 1,664 | 30,641 | 38 | 1,295 | 608 | 4,371 | 1,031 | 2,606 | 485 | 2,623 | 818 | 34,024 | 63 | $1,845 |
| Stowe | 1,737 | 33,636 | 57 | 1,330 | 652 | 5,446 | 1,086 | 3,089 | 498 | 2,452 | 676 | 27,662 | ........ | ........ |
| Waterville | 238 | 4,860 | 8 | 225 | 147 | 1,257 | 76 | 183 | 58 | 319 | 179 | 5,863 | ........ | ........ |
| Wolcott | 884 | 16,726 | 22 | 775 | 370 | 3,005 | 510 | 1,369 | 239 | 1,326 | 404 | 17,560 | ........ | ........ |
| Total | 9,919 | $181,542 | 207 | $5,830 | 3,737 | $28,618 | 5,096 | $13,189 | 2,867 | $13,533 | 4,071 | $157,528 | 63 | $1,845 |
| U. S. Census, 1890 | 11,132 | | 1,256 | | 6,313 | | 7,037 | | 3,772 | | 3,703 | | | |

Morristown—Mules; 13. Value, $675.

## CENSUS OF LIVE STOCK.

| ORANGE COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock. | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bradford | 860 | $17,996 | 34 | $1,580 | 308 | $2,609 | 535 | $ 953 | 276 | $1,567 | 605 | $21,389 | ........ | ........ |
| Braintree | 904 | 17,844 | 14 | 539 | 405 | 3,124 | 1,608 | 3,462 | 303 | 1,293 | 301 | 11,255 | 51 | $1,428 |
| Brookfield | 1,494 | 32,087 | ........ | ........ | 814 | 8,297 | 428 | 881 | 504 | 2,619 | 584 | 24,269 | ........ | ........ |
| Chelsea | 764 | 17,782 | 42 | 1,610 | 335 | 3,000 | 752 | 1,619 | 197 | 1,763 | 529 | 21,105 | 45 | 1,000 |
| Corinth | 1,032 | 22,242 | 90 | 4,030 | 459 | 4,496 | 1,160 | 2,952 | 257 | 1,261 | 469 | 19,141 | ........ | ........ |
| Fairlee | 450 | 7,310 | 14 | 790 | 151 | 1,111 | 211 | 290 | 164 | 964 | 154 | 5,808 | 12 | 160 |
| Newbury | 2,106 | 42,352 | 40 | 1,735 | 844 | 7,684 | 1,226 | 2,201 | 585 | 2,861 | 658 | 28,110 | ........ | ........ |
| Orange | 644 | 13,403 | 92 | 4,080 | 162 | 2,559 | 544 | 894 | 244 | 1,253 | 275 | 8,996 | ........ | ........ |
| Randolph | 3,174 | 77,335 | 14 | 810 | 946 | 9,460 | 790 | 2,270 | 1,114 | 6,860 | 1,231 | 63,551 | ........ | ........ |
| Strafford | 649 | 13,629 | 68 | 3,264 | 352 | 3,872 | 905 | 2,715 | 217 | 1,031 | 432 | 17,280 | ........ | ........ |
| Thetford | 1,038 | 19,622 | 65 | 2,200 | 467 | 3,204 | 765 | 823 | 251 | 1,306 | 391 | 18,778 | 7 | 150 |
| Topsham | 1,222 | 26,765 | 56 | 2,875 | 306 | 2,805 | 455 | 1,521 | 345 | 1,712 | 495 | 19,606 | ........ | ........ |
| Tunbridge | 925 | 17,351 | 77 | 3,185 | 421 | 3,932 | 1,408 | 2,545 | 284 | 1,451 | 530 | 18,886 | ........ | ........ |
| Vershire | 477 | 9,321 | 65 | 2,680 | 299 | 2,541 | 427 | 702 | 113 | 656 | 261 | 8,620 | ........ | ........ |
| Washington | 717 | 13,538 | 69 | 3,082 | 291 | 2,286 | 791 | 1,306 | 293 | 1,389 | 448 | 14,082 | ........ | ........ |
| West Fairlee | 393 | 8,094 | 36 | 1,710 | 160 | 1,645 | 242 | 461 | 79 | 455 | 297 | 6,272 | ........ | ........ |
| Williamstown | 1,258 | 27,051 | 20 | 1,187 | 492 | 4,275 | 798 | 2,698 | 509 | 3,224 | 566 | 21,780 | ........ | ........ |
| Total | 18,107 | $383,722 | 796 | $35,357 | 7,212 | $66,898 | 13,045 | $28,293 | 5,735 | $31,665 | 8,226 | $328,928 | 115 | $2,738 |
| U. S. Census, 1890 | 15,171 | | 3,122 | | 10,479 | | 43,640 | | 8,370 | | 7,506 | | | |

## CENSUS OF LIVE STOCK.

| ORLEANS COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albany | 1,520 | $33,992 | 4 | $130 | 541 | $5,230 | 614 | $3,000 | 224 | $1,353 | 476 | $19,872 | | |
| Barton | 1,539 | 33,943 | 6 | 300 | 643 | 6,651 | 1,428 | 6,181 | 331 | 2,126 | 752 | 31,282 | | |
| Browington | 976 | 20,426 | 6 | 210 | 463 | 4,559 | 847 | 1,948 | 226 | 1,083 | 382 | 14,930 | | |
| Charleston | 1,323 | 30,833 | 20 | 760 | 500 | 4,524 | 923 | 2,731 | 324 | 1,763 | 525 | 21,136 | | |
| Coventry | 703 | 17,353 | | | 433 | 6,995 | 816 | 4,389 | 175 | 962 | 345 | 13,730 | | |
| Craftsbury | 1,719 | 36,525 | 13 | 525 | 496 | 4,461 | 413 | 1,295 | 349 | 5,852 | 540 | 25,325 | | |
| Derby | 2,058 | 46,486 | 2 | 80 | 893 | 7,663 | 1,082 | 3,217 | 603 | 3,171 | 1,066 | 45,778 | | |
| Glover | | | | | | | | | | | | | | |
| Greensboro | 1,320 | 28,509 | 2 | 30 | 476 | 4,169 | 706 | 2,001 | 281 | 1,180 | 311 | 13,925 | 174 | $3,853 |
| Holland | | | | | | | | | | | | | | |
| Irasburgh | 1.608 | 31,893 | 10 | 350 | 548 | 4,991 | 772 | 3,354 | 351 | 1,584 | 455 | 17,103 | | |
| Jay | 600 | 12,000 | 6 | 120 | 240 | 1,920 | 125 | 375 | 88 | 440 | 76 | 3,000 | 2 | 27 |
| Lowell | 1,204 | 24,876 | 2 | 40 | 541 | 3.972 | 324 | 955 | 217 | 1,039 | 453 | 16,590 | | |
| Morgan | 635 | 12,718 | | | 262 | 2,007 | 426 | 1,289 | 147 | 642 | 279 | 9,636 | | |
| Newport | 1,896 | 38,532 | 6 | 165 | 560 | 4,622 | 565 | 1,693 | 352 | 1,478 | 817 | 35,520 | | |
| Troy | 1,328 | 29,449 | 6 | 215 | 548 | 4,595 | 581 | 1,650 | 192 | 908 | 471 | 17,670 | | |
| Westfield | 853 | 15,337 | | | 284 | 2,297 | 248 | 705 | 135 | 661 | 268 | 10,643 | 15 | 411 |
| Westmore | 326 | 6,874 | 12 | 365 | 173 | 1,553 | 366 | 1,072 | 83 | 479 | 124 | 5,500 | 48 | 1,199 |
| Total | 19,608 | $419,746 | 95 | $3,290 | 7,601 | $70,209 | 10,234 | $35,855 | 4,078 | $24,721 | 7,340 | $301,640 | 239 | $5,490 |
| U. S. Census 1890 | 21,261 | | 1,263 | | 10,937 | | 16,057 | | 6,685 | | 8,154 | | | |

Barton, five Mules, $135.00.

## CENSUS OF LIVE STOCK.

| RUTLAND COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock | Value. | Sheep | Value. | Hogs. | Value. | Hors'. | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benson | 1,124 | $25,014 | 2 | $ 70 | 585 | $6,023 | 1,889 | $ 5,194 | 267 | $1,193 | $499 | 18,495 | ........ | .......... |
| Brandon | 559 | 15,378 | 6 | 275 | 494 | 5,330 | 1,585 | 2,602 | 204 | 1,016 | 621 | 25,606 | ........ | .......... |
| Castleton | 1,017 | 22,588 | 2 | 75 | 579 | 5,326 | 703 | 1,961 | Not re | ported. | 596 | 20,587 | ........ | .......... |
| Chittenden | 687 | 14,878 | 24 | 970 | 319 | 2,878 | 133 | 396 | 159 | 932 | 315 | 12,595 | ........ | .......... |
| Clarendon | 1,443 | 35,387 | 5 | 250 | 520 | 5,010 | 400 | 1,274 | 348 | 1,918 | 427 | 15,470 | ........ | .......... |
| Danby | 1,342 | 26,840 | 12 | 360 | 363 | 3,630 | 501 | 1,250 | 335 | 1,000 | 1,090 | 32,700 | ........ | .......... |
| Fair Haven | 385 | 7,700 | 2 | 100 | 96 | 864 | 86 | 258 | 70 | 350 | 307 | 15,350 | 53 | $ 930 |
| Hubbardton | 596 | 12,668 | 4 | 175 | 290 | 2,645 | 1,352 | 2,864 | 121 | 680 | 270 | 8,800 | ........ | .......... |
| Ira | 555 | 10,020 | 8 | 335 | 221 | 2,240 | 325 | 642 | 120 | 492 | 162 | 8,220 | ........ | .......... |
| Mendon | 298 | 5,644 | 34 | 1,465 | 150 | 1,511 | 136 | 695 | 88 | 406 | 197 | 8,364 | 20 | 729 |
| Middletown | 995 | 20,685 | 4 | 200 | 350 | 2,465 | 320 | 840 | 182 | 1,092 | 263 | 6,405 | ........ | .......... |
| Mt. Holly | Not re | ported... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... |
| Mt. Tabor | 50 | 1,250 | 12 | 360 | 12 | 120 | 100 | 150 | 4 | 20 | 97 | 3,600 | ........ | .......... |
| Pawlet | Not re | ported... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... |
| Pittsfield | 305 | 7,075 | 12 | 300 | 114 | 1,140 | 150 | 450 | 75 | 375 | 225 | 11,250 | ........ | .......... |
| Pittsford | 1,662 | 34,337 | 2 | 80 | 758 | 9,847 | 434 | 1,396 | 434 | 2,556 | 595 | 25,970 | ........ | .......... |
| Poultney | Not re | ported... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... |
| Proctor | 210 | 5,030 | 2 | 120 | 104 | 811 | 169 | 381 | 26 | 166 | 192 | 11,790 | 4 | 125 |
| Rutland | 1,100 | 26,239 | ........ | .......... | 370 | 4,243 | 607 | 2,076 | 197 | 921 | ........ | .......... | ........ | .......... |
| Sherburne | 310 | 6,886 | 20 | 1,040 | 200 | 2,295 | 259 | 904 | 88 | 498 | 215 | 7,507 | ........ | .......... |
| Shrewsbury | 1,734 | 42,656 | 12 | 530 | 344 | 3,556 | 229 | 1,069 | 350 | 2,556 | 402 | 14,807 | ........ | .......... |
| Sudbury | 350 | 8,125 | ........ | .......... | 175 | 2,187 | 900 | 15,750 | 150 | 900 | 150 | 7,500 | 170 | 5,500 |
| Tinmouth | 973 | 18,250 | 6 | 225 | 333 | 2,885 | 218 | 466 | 151 | 837 | 216 | 7,445 | 7 | 350 |
| Wallingford | 1,377 | 27,540 | 2 | 65 | 316 | 3,000 | 336 | 600 | 237 | 1,185 | 470 | 18,300 | ........ | .......... |
| Wells | 608 | 14,367 | ........ | .......... | 255 | 2,311 | 221 | 485 | 138 | 520 | 245 | 9,404 | 18 | 735 |
| West Haven | 630 | 15,278 | ........ | .......... | 303 | 2,967 | 1,564 | 4,986 | 147 | 870 | 257 | 12,715 | 23 | 555 |
| West Rutland | 696 | 13,639 | ........ | .......... | 260 | 2,397 | 388 | 1,135 | 224 | 1,077 | 350 | 11,353 | ........ | .......... |
| Total | 19,006 | $417,474 | 171 | $6,995 | 7,511 | $75,681 | 13,005 | $47,824 | 4,115 | $21,560 | 8,161 | $314,233 | 295 | $8,924 |
| U. S. Census 1890 | 25,361 | | 886 | | 15,609 | | 30,708 | | 8,058 | | 8,932 | | | |

## CENSUS OF LIVE STOCK.

| WASHINGTON COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barre | 1,200 | $ 2,410 | 14 | $ 665 | 450 | $3,017 | 421 | $ 840 | 380 | $1,995 | 1,266 | $41,930 | ........ | .......... |
| Berlin | 1,462 | 31,356 | 11 | 310 | 513 | 4,628 | 631 | 1,513 | 540 | 2,843 | 508 | 21,707 | 32 | $ 995 |
| Cabot | 1,500 | 30,876 | ........ | .......... | 848 | 5,000 | 452 | 1,024 | 423 | 1,843 | 594 | 21,703 | ........ | .......... |
| Calais | 948 | 18,980 | 16 | 533 | 333 | 2,467 | 397 | 992 | 291 | 2,591 | 396 | 16,452 | ........ | .......... |
| Duxbury | 788 | 15,172 | 72 | 2,120 | 375 | 3,375 | 236 | 650 | 225 | 1,013 | 274 | 11,370 | 46 | 1,015 |
| East Montpelier | 1,748 | 34,637 | 16 | 695 | 471 | 4,278 | 356 | 720 | 633 | 4,000 | 556 | 22,000 | ........ | .......... |
| Fayston | 603 | 13,266 | 47 | 2,133 | 227 | 1,894 | 185 | 555 | 168 | 1,008 | 230 | 9,200 | ........ | .......... |
| Marshfield | 1,707 | 28,675 | 94 | 3,700 | 740 | 7,513 | 414 | 985 | 440 | 2,150 | 727 | 28,675 | ........ | .......... |
| Middlesex | 1,111 | 20,371 | 25 | 954 | 331 | 2,744 | 107 | 281 | 412 | 1,615 | 372 | 12,918 | 21 | 510 |
| Montpelier | 323 | 6,463 | 3 | 140 | 53 | 265 | 22 | 55 | 200 | 1,000 | 484 | 19,360 | 12 | 240 |
| Moretown | 1,082 | 21,903 | 46 | 1,735 | 315 | 3,110 | 238 | 867 | 378 | 1,803 | 435 | 16,655 | ........ | .......... |
| Northfield | 1,321 | 30,474 | 19 | 795 | 495 | 4,741 | 842 | 2,441 | 515 | 2,545 | 709 | 32,410 | ........ | .......... |
| Plainfield | 703 | 14,933 | 26 | 11,50 | 398 | 3,411 | 343 | 589 | 296 | 1,781 | 319 | 9,700 | ........ | .......... |
| Roxbury | 612 | 13,275 | 34 | 1,225 | 282 | 2,479 | 534 | 1,593 | 186 | 986 | 336 | 11,951 | 7 | 195 |
| Waitsfield | 1,072 | 26,032 | 50 | 2,285 | 468 | 4,738 | 343 | 1,335 | 343 | 2,039 | 397 | 16,970 | ........ | .......... |
| Warren | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... |
| Waterbury | 1,877 | 36,632 | 48 | 1,425 | 652 | 5,505 | 510 | 1,160 | 700 | 3,045 | 730 | 26,984 | ........ | .......... |
| Woodbury | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... | ........ | .......... |
| Worcester | 464 | 8,953 | 16 | 410 | 201 | 1,299 | 344 | 640 | 209 | 1,086 | 324 | 11,175 | ........ | .......... |
| Total | 18,521 | $354,408 | 537 | $20,275 | 7,162 | $60,464 | 6,375 | $16,240 | 6,339 | $33,343 | 8,657 | $331,160 | 118 | $2,955 |
| U. S. Census, 1890 | 21,397 | | 2,325 | | 11,686 | | 15,662 | | 9,588 | | 7,454 | | | |

Worcester—Mules, 4. Value, $130.

## CENSUS OF LIVE STOCK.

| WINDHAM COUNTY. | Cows. | Value. | Oxen. | Value. | Other Neat Stock. | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Athens | 175 | $ 3,703 | 26 | $1,141 | 108 | $1,170 | 79 | $ 182 | 36 | $ 193 | 67 | $ 1,790 | ........ | ........ |
| Brattleboro | 1,038 | 26,051 | 48 | 2,665 | 449 | 5,222 | 361 | 1,052 | 479 | 2,718 | 870 | 47,699 | ........ | ........ |
| Brookline | 142 | 3,235 | 14 | 585 | 172 | 1,784 | 230 | 511 | 58 | 316 | 63 | 2,900 | 7 | $ 153 |
| Dover | 359 | 8,374 | 53 | 2,212 | 282 | 3,497 | 597 | 1,968 | 68 | 440 | 220 | 11,238 | 14 | 435 |
| Dummerston | 621 | 16,552 | 30 | 1,508 | 411 | 6,375 | 376 | 1,412 | 255 | 1,699 | 334 | 14,789 | ........ | ........ |
| Grafton | 418 | 7,117 | 34 | 1,387 | 189 | 1,816 | 818 | 1,367 | 155 | 713 | 264 | 10,690 | ........ | ........ |
| Guilford | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ |
| Halifax | 555 | 13,043 | 84 | 4,000 | 237 | 2,985 | 774 | 2,370 | 190 | 644 | 284 | 13,064 | ........ | ........ |
| Jamaica | 235 | 5,520 | 42 | 1,850 | 117 | 1,307 | 334 | 863 | 78 | 406 | 207 | 8,565 | ........ | ........ |
| Londonderry | 716 | 21,480 | 15 | 1,587 | 1,600 | 16,000 | 500 | 1,500 | 400 | 2,000 | 630 | 31,600 | 63 | 2,360 |
| Marlboro | 258 | 6,065 | 61 | 2,966 | 227 | 3,260 | 597 | 1,609 | 98 | 493 | 207 | 7,727 | ........ | ........ |
| Newfane | 482 | 12,602 | 38 | 1,667 | 301 | 3,668 | 594 | 2,059 | 150 | 822 | 302 | 14,878 | 23 | 900 |
| Putney | 896 | 20,822 | 24 | 1,115 | 374 | 4,255 | 509 | 992 | 184 | 979 | 245 | 12,390 | 28 | 690 |
| Rockingham | 877 | 22,944 | 18 | 880 | 582 | 8,995 | 1,261 | 4,141 | 229 | 1,359 | 742 | 39,782 | ........ | ........ |
| Somerset | 29 | 870 | ........ | ........ | 6 | 36 | 42 | 126 | 6 | 30 | 52 | 4,680 | 1 | 20 |
| Stratton | 61 | 1,251 | 4 | 150 | 33 | 303 | 177 | 485 | 14 | 79 | 79 | 2,503 | ........ | ........ |
| Townsend | 670 | 13,751 | 74 | 2,895 | 435 | 3,765 | 485 | 1,101 | 175 | 827 | 288 | 9,948 | ........ | ........ |
| Vernon | 565 | 15,359 | 15 | 490 | 248 | 2,846 | 109 | 349 | 189 | 1,002 | 193 | 7,947 | 12 | 340 |
| Wardsboro | 330 | 6,498 | ........ | ........ | 193 | 2,546 | 412 | 1,256 | 93 | 750 | 217 | 8,760 | ........ | ........ |
| Westminster | 906 | 24,915 | 4 | 135 | 659 | 9,226 | 1,794 | 3,231 | 270 | 1,946 | 541 | 30,296 | ........ | ........ |
| Whitingham | 687 | 17,192 | 70 | 3,315 | 401 | 4,682 | 547 | 1,687 | 187 | 1,297 | 399 | 17,000 | ........ | ........ |
| Wilmington | 837 | 20,764 | 66 | 3,200 | 511 | 6,496 | 975 | 2,908 | 168 | 1,157 | 437 | 19,845 | ........ | ........ |
| Windham | 293 | 7,205 | 34 | 1,240 | 217 | 2,380 | 585 | 1,315 | 88 | 470 | 225 | 9,850 | ........ | ........ |
| Totals | 11,150 | $275,313 | 754 | $34,988 | 7,752 | $92,614 | 12,156 | $32,484 | 3,570 | $20,340 | 6,866 | $327,941 | 148 | $4,898 |
| U. S. Census, 1890 | 11,439 | | 2,845 | | 15,368 | | 29,306 | | 6,484 | | 5,602 | | | |

## CENSUS OF LIVE STOCK.

| WINDSOR COUNTY. | Cows. | Value, | Oxen. | Value. | Other Neat Stock | Value. | Sheep | Value. | Hogs. | Value. | Hors' | Value. | Colts. | Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Andover | 439 | $10,572 | 34 | $1,835 | 302 | $3,646 | 424 | $1,043 | 151 | $ 734 | 239 | $ 8,622 | ... | ... |
| Baltimore | 57 | 1,150 | 8 | 355 | 47 | 593 | ... | ... | 12 | 60 | 36 | 1,445 | 8 | $ 260 |
| Barnard | 708 | 16,082 | 57 | 2,715 | 398 | 4,765 | 1,436 | 3,937 | 206 | 1,141 | 350 | 18,952 | 19 | 690 |
| Bethel | 1,075 | 26,760 | 24 | 900 | 510 | 5,610 | 830 | 2,000 | 400 | 2,100 | 270 | 8,500 | 50 | 1,050 |
| Bridgewater | 586 | 12,221 | 83 | 3,560 | 221 | 2,602 | 1,074 | 2,344 | 167 | 828 | 389 | 15,158 | ... | ... |
| Cavendish | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Chester | 1,307 | 32,453 | 70 | 3,292 | 658 | 9,191 | 323 | 937 | 383 | 1,855 | 700 | 33,186 | ... | ... |
| Hartford | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Hartland | 1,127 | 25,697 | 100 | 5,656 | 540 | 6,996 | 2,024 | 3,538 | 374 | 2,612 | 662 | 30,305 | ... | ... |
| Ludlow | 656 | 13,985 | 26 | 995 | 316 | 3,270 | 447 | 977 | 209 | 1,026 | 449 | 19,347 | 23 | 675 |
| Norwich | 1,120 | 22,374 | 77 | 2,928 | 503 | 3,930 | 858 | 1,151 | 347 | 1,935 | 532 | 19,417 | ... | ... |
| Plymouth | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Pomfret | 931 | 21,609 | 72 | 3,561 | 610 | 7,046 | 1,461 | 1,984 | 267 | 1,554 | 426 | 18,035 | ... | ... |
| Reading | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Rochester | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Royalton | 1,038 | 22,728 | 46 | 1,645 | 409 | 3,970 | 1,262 | 2,809 | 373 | 1,548 | 572 | 22,750 | ... | ... |
| Sharon | 499 | 11,016 | 34 | 1,690 | 321 | 2,696 | 611 | 1,484 | 201 | 1,221 | 347 | 14,727 | ... | ... |
| Springfield | 1,179 | 28,725 | 14 | 620 | 681 | 8,034 | 2,491 | 6,382 | 387 | 2,047 | 895 | 45,033 | ... | ... |
| Stockbridge | 582 | 12,564 | 41 | 1,765 | 308 | 3,264 | 713 | 1,522 | 146 | 754 | 335 | 12,570 | ... | ... |
| Weathersfield | 1,190 | 25,184 | 47 | 2,420 | 624 | 6,715 | 1,554 | 2,535 | 395 | 2,343 | 504 | 19,895 | ... | ... |
| Weston | 675 | 16,295 | 16 | 634 | 265 | 3,050 | 345 | 1,100 | 150 | 875 | 315 | 16,000 | 25 | 745 |
| West Windsor | 546 | 13,163 | 30 | 1,625 | 316 | 3,259 | 916 | 1,702 | 148 | 786 | 240 | 10,857 | ... | ... |
| Windsor | 697 | 20,282 | 14 | 940 | 217 | 3,170 | 399 | 655 | 203 | 1,123 | 365 | 21,005 | 6 | 195 |
| Woodstock | 1,209 | 26,963 | 106 | 4,912 | 588 | 6,954 | 1,772 | 3,694 | 358 | 2,367 | 677 | 36,100 | 85 | 2,885 |
| Total | 15,621 | $359,823 | 899 | $42,048 | 7,834 | $88,761 | 18,940 | $40,094 | 4,877 | $26,909 | 8,303 | $371,904 | 216 | $6,500 |
| U. S. Census, 1890 | 19,507 | | 3,692 | | 16,771 | | 66,227 | | 9,347 | | 9,362 | | | |

Recapitulation showing gain and loss from United States Census of 1890 and my Census April 1, 1897, after making liberal allowance for all missing towns.

## LOSSES.

| BY COUNTIES. | Cows. | Oxen. | Other Neat Stock. | Sheep. | Hogs. | Horses. |
|---|---|---|---|---|---|---|
| Addison | ........ | 400 | 3,000 | 28,000 | 1,600 | ........ |
| Bennington | 2,103 | 529 | 3,824 | 15,461 | 2,136 | ........ |
| Caledonia | ........ | 1,540 | 2,208 | 12,045 | 1,749 | ........ |
| Chittenden | 2,511 | 513 | 2,729 | 4,102 | 1,850 | ........ |
| Essex | ........ | 795 | 1,770 | 2,153 | 360 | ........ |
| Franklin | 7,000 | 732 | 2,108 | 4,325 | 2,[illegible]58 | ........ |
| Grand Isle | ........ | 29 | 39 | 2,972 | 536 | 229 |
| Lamoille | ........ | 1,009 | 2,126 | 1,291 | 205 | ........ |
| Orange | ........ | 2,326 | 3,267 | 30,595 | 2,635 | ........ |
| Orleans | ........ | 1,150 | 2,636 | 4,921 | 1,800 | ........ |
| Rutland | 3,361 | 706 | 6,669 | 16,300 | 3,047 | ........ |
| Washington | 2,476 | 1,775 | 4,324 | 8,847 | 3,048 | ........ |
| Windham | 239 | 2,075 | 7,360 | 17,000 | 2,800 | ........ |
| Windsor | ........ | 2,000 | 6,000 | 43,000 | 2,900 | ........ |
| Total | 17,690 | 15,579 | 48,060 | 191,012 | 27,624 | 229 |

## GAINS.

| COUNTIES. | Cows. | Oxen. | Other Neat Stock. | Sheep. | Hogs. | Horses. |
|---|---|---|---|---|---|---|
| Addison | 446 | ........ | ........ | ........ | ........ | 350 |
| Bennington | ........ | ........ | ........ | ........ | ........ | ........ |
| Caledonia | 2,000 | ........ | ........ | ........ | ........ | 1,000 |
| Chittenden | ........ | ........ | ........ | ........ | ........ | 1,222 |
| Essex | 340 | ........ | ........ | ........ | ........ | 678 |
| Franklin | ........ | ........ | ........ | ........ | ........ | 255 |
| Grand Isle | 871 | ........ | ........ | ........ | ........ | ........ |
| Lamoille | 187 | ........ | ........ | ........ | ........ | 1,200 |
| Orange | 2,936 | ........ | ........ | ........ | ........ | 835 |
| Orleans | 147 | ........ | ........ | ........ | ........ | 125 |
| Rutland | ........ | ........ | ........ | ........ | ........ | 824 |
| Washington | ........ | ........ | ........ | ........ | ........ | 1,626 |
| Windham | ........ | ........ | ........ | ........ | ........ | 1,312 |
| Windsor | ........ | ........ | ........ | ........ | ........ | 1,700 |
| Total | 6,927 | | | | | 11,127 |

REDUCTION OF LIVE STOCK IN THE STATE FROM JUNE 1, 1890, U. S. CENSUS TO APRIL 1, 1897.

| | |
|---|---|
| Cows | 10,763 |
| Oxen | 15,579 |
| Other cattle | 48,060 |
| Total | 74,402 |
| Sheep | 191,012 |
| Hogs | 27,624 |

Increase in horses......................10,898

TOTAL LIVE STOCK IN STATE APRIL 1, 1897.

| | |
|---|---|
| Cows | 220,656 |
| Oxen | 5,670 |
| Other cattle | 94,560 |
| Sheep | 142,935 |
| Hogs | 64,459 |
| Horses | 100,867 |

## CASH VALUE OF GAINS AND LOSSES BY COUNTIES, APRIL 1, 1897.

| COUNTIES. | Loss. | Gain. | Net Loss. |
|---|---|---|---|
| Addison | $117,200 | $19,770 | $ 97,430 |
| Bennington | 143,572 | 0 | 143,572 |
| Caledonia | 212,768 | 80,000 | 132,768 |
| Chittenden | 97,972 | 48,880 | 49,092 |
| Essex | 45,162 | 29,512 | 15,650 |
| Franklin | 185,735 | 10,200 | 175,535 |
| Grand Isle | 17,000 | 15,678 | 1,322 |
| Lamoille | 50,100 | 25,050 | 25,050 |
| Orange | 214,711 | 95,345 | 119,366 |
| Orleans | 91,900 | 8,712 | 83,188 |
| Rutland | 231,465 | 32,760 | 198,705 |
| Washington | 186,483 | 61,788 | 124,695 |
| Windham | 248,325 | 61,664 | 186,661 |
| Windsor | 261,083 | 74,800 | 186,283 |

Net loss in live stock from June 1, 1890, U. S. Census to April 1, 1897, Valuation, April 1, 1897....$1,539,317

There is food for reflection by our farmers in the thought that in seven years the live stock of the state has been reduced 74,402 in cattle, 191,012 in sheep, and that thousands of acres of pasture are not used for grazing. Then, too, we are paying out over ($3,000,000) three million dollars per year for imported feeds to maintain what stock we have. With our fertile soil and the present appliances and methods by which crops are raised much more easily than formerly, this does not seem like sound business policy. I believe our flocks and herds should be greatly increased and our grain bills *greatly reduced.*

# ACCOUNT OF GRAIN AND FEED SOLD BY DEALERS IN VERMONT AT RETAIL TO THE CONSUMERS DURING 1896.

By corresponding with the Town Clerks I received the addresses of 451 grain dealers in the state to whom I addressed circulars asking for information as to the amount of grain feed sold by them to consumers in 1896, and I received replies from 269 of such dealers whose report follows. Seventeen of twenty-five dealers in Addison to report sales of

| COUNTY. | Tons Corn. | Tons Meal Bran. | Tons Middlings | Bushels of Oats. | Tons Cot'n-seed. | Tons Gluten. | Bushels Wh'at | Tons Other Feeds |
|---|---|---|---|---|---|---|---|---|
| | 2,179 | 640 | 690 | 34,800 | 56 | 52 | 1,251 | 91 |
| 17 of 30 in Bennington | 2,756 | 284 | 977 | 54,800 | 10 | 4 | 480 | 107 |
| 22 of 35 in Caledonia... | 17,680 | 7,607 | 2,197 | 126,635 | 866 | 1,741 | 8,087 | 1,811 |
| 15 of 20 in Chittenden | 2,711 | 2,536 | 532 | 25,600 | 76 | 194 | 2,650 | 380 |
| 6 of 13 in Essex........... | 1,354 | 805 | 840 | 101,722 | ........ | 60 | 200 | ........ |
| 21 of 35 in Franklin... | 2,981 | 2,363 | 1,018 | 38,025 | 83 | 754 | 220 | 2,187 |
| 2 of 9 in Grand Isle..... | 3 | ½ | ½ | ......... | ........ | ........ | ......... | ........ |
| 13 of 22 in Lamoille.... | 3,389 | 1,507 | 379 | 24,925 | 125 | 270 | 600 | 262 |
| 25 of 39 in Orange...... | 3,631 | 1,576 | 594 | 42,235 | 262 | 258 | 1,400 | 180 |
| 27 of 40 in Orleans...... | 5,590 | 3,105 | 826 | 55,626 | 221 | 341 | 3,880 | 656 |
| 30 of 49 in Rutland..... | 9,389 | 2,775 | 2,138 | 167,375 | 188 | 298 | 2,122 | 479 |
| 19 of 43 in Washington | 5,436 | 1,899 | 901 | 40,742 | 312 | 211 | 340 | 300 |
| 26 of 43 in Windham.. | 3,674 | 1,998 | 604 | 62,053 | 342 | 149 | 1,547 | 137 |
| 29 of 50 in Windsor.... | 6,498 | 2,054 | 999 | 103,850 | 193 | 229 | 3,095 | 565 |
| Total................. | 67,271 | 29,149 | 12,694 | 878,387 | 2,734 | 4,561 | 25,872 | 7,155 |

67,271 tons of Corn Meal at $13.50............................................$ 908,158
878,387 bushels of Oats at 35c......... ........................................ 307,435

Total..........................................................................$1,215,593

29,149 tons of Bran at $13.50....................................................$ 393,512
12,694 tons of Middlings at $15.25............................................ 193,583
25,872 bushels of Wheat at 50c................................................ 12,936

Total.......................................................................... $600,031

2,734 tons of Cottonseed Meal at $22.00.....................................$ 60,148
4,561 tons of Gluten at $16.50................................................. 75,257

Total.......................................................................... $135,405

| | | |
|---|---|---|
| 7,155 tons of other seeds at $13.50 | | $ 96,592 |
| Total | | $2,047,601 |
| Of above there was raised in Vermont 17,090 bushels of Oats at 55c | $ 5,981 | |
| 878 tons of feed at $13.50 | 11,853 | |
| | | $17,834 |
| 269 dealers sold of foreign raised feeds in 1896 | | $2,029,787 |
| By no method of figuring can I estimate the sales of the 182 dealers not heard from (some of whom are large dealers] at less than | | $1,000,000 |
| Making a grand total of | | $3,029,787 |

The above figures show that we paid out $1,800,000 in round numbers for corn and oats raised in other states, $900,000 for wheat and wheat products. And it becomes a serious question, whether a large part of this might not be raised here.

F. C. WILLIAMS,

Assistant Secretary.

## EXPENSES OF BOARD OF AGRICULTURE FROM DECEMBER 1, 1896, TO JULY 1, 1898.

| | | |
|---|---|---|
| **V. I. Spear.** | | |
| Services | $900 00 | |
| Expenses | 868 39 | |
| | | $1,768 39 |
| **F. C. Williams.** | | |
| Services Institutes | $416 00 | |
| " as Assistant Secretary | 304 75 | |
| Expenses | 483 20 | |
| | | $1,203 95 |
| **C. J. Bell.** | | |
| Services | $403 00 | |
| Expenses | 230 22 | |
| | | $ 633 22 |
| **Alpha Messer.** | | |
| Services | $460 00 | |
| Expenses | 296 83 | |
| | | $ 756 83 |
| **J. O. Sanford.** | | |
| Services | $443 00 | |
| Expenses | 292 69 | |
| | | $ 735 69 |
| **James K. Curtis.** | | |
| Services | $348 00 | |
| Expenses | 206 18 | |
| | | $ 554 18 |
| **J. L. Hills.** | | |
| Services | $278 00 | |
| Expenses | 217 18 | |
| | | $ 495 18 |
| **J. H. Ware.** | | |
| Services | $160 00 | |
| Expenses | 135 05 | |
| | | $ 295 05 |
| **Homer W. Vail.** | | |
| Services and expenses | $ 53 30 | |
| F. A. Waugh, Services and expenses | 67 94 | |
| M. C. Robbins, " " " | 14 26 | |
| Expt. Station, " " " | 10 00 | |
| Free Press, " " " | 52 68 | |
| Newport Express, printing | 35 05 | |
| L. R. Jones, services and expenses | 25 16 | |
| M. H. Buckham, expenses | 7 32 | |
| G. E. Stratton, reporting | 42 40 | |
| F. A. Converse | 39 80 | |
| Geo. L. Clemence | 13 98 | |
| Total expenditure | | $6,804 38 |

V. I. SPEAR, Secretary.

## REPORT OF THE BOARD OF AGRICULTURE AS CATTLE COMMISSIONERS.

The work done by the Board of Agriculture in the discharge of their duties as Cattle Commissioners during the past year has been along the same lines and in continuation of the policy outlined in our previous reports. No new rules or regulations have been adopted during the year, and those previously adopted have been continued in force. The work done as Cattle Commissioners has been confined almost exclusively to bovine tuberculosis. As will be seen by the following pages of this report a large amount of work has been called for in this connection, and all requests made, that have come within our regulations for testing, have been complied with. At the present time there are no requests for testing awaiting our action. Nearly every day, however, brings one or more applications for this work, and we are now able to comply with requests received with very little delay. The prejudice and distrust which at first attended the execution of this work has largely disappeared and the farmers of the State now regard the provisions of our law for testing cattle for tuberculosis and of paying a partial indemnity for those found to be diseased, as legislation intended for their relief.

### POLICY OF THE BOARD.

The policy of the Board from the beginning, with reference to bovine tuberculosis, has been to do thorough work wherever work has been done. We have believed it to be a waste of public funds to take out of herds cases that had commenced to show physical decline and leave the milder cases to develop and spread the disease. We have found that the only practical source of spreading the disease in a herd, is the presence of diseased animals, and when the last case has been removed and stables

properly disinfected, the disease has disappeared. For this reason no test has been made except where *all* the animals belonging to a herd could be tested, and all animals that have made reactions to the tuberculin test have been killed. We are satisfied that for Vermont the policy adopted has been the most economical policy that could have been pursued. The localities in which tests were first made are to-day practically free from disease, and only care is necessary on the part of owners of stock to keep them so. If Vermont had from 20 to 50 per cent. of its stock diseased we might hesitate to incur the large loss which would follow the policy now pursued, and other methods of dealing with this subject may be preferable to ours for other sections; but for Vermont, with less than 4 per cent. of its cattle affected with tuberculosis, the method which has for its object the permanent suppression of the disease is likely to be the most satisfactory to the State as well as the cheapest in the end.

Since February 1, 1895, 60,000 cattle have been tested in this State; 2390 have been found diseased and killed, and about $55,-000 has been paid by the State for the cattle killed and for doing this work. Of this amount $35,948.42 has been paid for cattle killed and $18,887.73 has been paid for testing and supervising the work. Under right conditions the progress of tuberculosis through a herd is quite rapid, and the conditions necessary to this end are the presence in a herd of a badly diseased animal and poor sanitary conditions in the stable. With the best of sanitary conditions there is great liability to the spread of the disease, and the only safe course for the stock owner is to have no case of tuberculosis in his herd. The policy of killing off the animals that show physical indications of disease is very unsafe, as it is a matter of common experience that often very advanced cases show no physical indications of disease, and these animals might communicate the disease to a large number of animals before being suspected. We believe that any policy that contemplates killing off only animals that show physical decline is calculated to insure a permanent supply of tuberculous animals and afford work for

Cattle Commissioners for all time. Under such a policy the percentage of tuberculous animals is practically certain to increase each year. We do not say that the last tuberculous animal will be disposed of in any State under any method that may be pursued, though there is no good reason why this cannot be done except that some owners of cattle are careless in regard to the condition of their herds. It is possible to eradicate tuberculosis from any herd. To eradicate it from a town or state simply requires that all owners of stock should use proper precautions. No law that can be enacted can do this; it rests with the individual stock owner. The experience of the Vermont Board in dealing with diseased herds is shown in the following list of re-tested herds in which disease was found on the first test. Many herds in which disease has been found have not yet been re-tested, but the following list embraces all of the re-tested herds to date, showing both the favorable and unfavorable results secured.

## CATTLE TESTED.

| Name. Address. | Date. | 1st Test. | Killed. | Date. | 2d Test. | Killed. | Date. | 3d Test. | Killed. | Date. | 4th Test. | Killed. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H. H. Wheeler, South Burlington.. | Apr. 27, 1895 | 25 | 4 | Dec. 1897 | 44 | 1 | May, 1898 | 2 | | | | |
| Chaffee Bros., Rutland................. | May 29, | 40 | 25 | May 26, | 6 | 1 | | | | | | |
| C. M. Winslow, Brandon............. | Dec. 16, | 60 | 3 | Nov. 1896 | 40 | 1 | | | | | | |
| C. E. Harris, Morrisville.............. | Jan. 13, | 20 | 11 | Aug. 20, 1897 | 27 | 3 | | | | | | |
| N. B. Powers, Leicester Junction... | Feb. 1, | 171 | 87 | June, 1897 | 76 | 5 | Nov. 29, 1897 | 33 | | | | |
| Warner Bros., St. Albans............. | Mar. 13, | 70 | 43 | April 22, 1895 | 50 | 17 | | | | | | |
| Marvin Clark, Williston............... | April 8, | 134 | 21 | Nov. 25, 1897 | 117 | 10 | Feb. 12, 1897 | 29 | 1 | Jan. 10, 1898 | 132 | 4 |
| Marvin W. Chapman, Williston..... | 9, | 66 | 22 | 18, | 69 | 7 | Feb. 12, 1897 | 18 | 11 | Nov. 30, 1897 | 67 | 11 |
| Benjamin E. Bates, Shoreham....... | 15, | 73 | 38 | Feb. 15, | 37 | 9 | | | | | | |
| George Dunsmore, St. Albans........ | 24, | 50 | 12 | Oct. 13, | 31 | 11 | May 25, 1898 | 25 | 1 | | | |
| J. M. Foss, St. Albans................. | 24, | 92 | 3 | April 12, | 80 | 1 | | | | | | |
| O. A. Barrows, Morrisville........... | May 5, | 14 | 2 | 22, | 18 | 3 | | | | | | |
| J. G. Mann, Randolph................. | 8, | 37 | 6 | March 9, | 64 | 1 | Nov. 7, 1897 | 3 | 2 | Feb. 18, 1898 | 1 | 1 |
| A. A. Priest, Randolph................ | 15, | 18 | 4 | Dec. 9, 1895 | 1 | 1 | Dec. 15, 1896 | 33 | | | | |
| L. B. Kibbee, North Randolph...... | June 2, | 12 | 7 | May 1, 1897 | 5 | 2 | June 13, 1898 | 16 | | | | |
| George Hebard, Braintree............ | 4, | 8 | 2 | June 28, 1897 | 7 | 1 | | | | | | |
| Henry Brockway, W. Hartford...... | Oct. 7, | 43 | 7 | Nov. 10, 1897 | 46 | 3 | | | | | | |
| John F. Mead, Randolph Center... | Nov. 9, | 26 | 4 | Mar. 11, 1896 | 20 | 3 | | | | | | |
| A. Alexander, Randolph, Center... | 9, | 29 | 1 | April 30, 1897 | 36 | 13 | | | | | | |
| D. D. Bulkley, Moretown............. | 18, | 39 | 7 | Dec. 27, | 4 | 1 | | | | | | |
| William H. Nichols, Randolph...... | 18, | 40 | 2 | June 22, 1896 | 32 | 3 | Aug. 20, 1896 | 1 | 1 | | | |
| H. C. Soper, Randolph................ | 18, | 44 | 9 | March 9, | 6 | | | | | | | |
| W. W. Grout, St. Johnsbury......... | Dec. 30, | 46 | 35 | Dec. 1, 1897 | 21 | 6 | | | | | | |
| F. V. Smith, Stowe...................... | Feb. 14, 1896 | 26 | 14 | Feb. 25, | 11 | 1 | | | | | | |
| C. C. Robinson, Stowe................. | 22, | 25 | 9 | Nov. 26, 1896 | 28 | 2 | | | | | | |
| L. H. Raymond, Stowe................ | Mar. 16, | 41 | 3 | Dec. 22, | 37 | 1 | | | | | | |

## CATTLE TESTED.

| Name. Address. | Date. | 1st Test. | Killed. | Date. | 2d Test. | Killed. | Date. | 3d Test. | Killed. | Date. | 4th Test. | Killed. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W. G. Baker, Stowe | Mar. 18, 1896 | 64 | 13 | Dec. 13, 1896 | 47 | 1 | | | | | | |
| E. B. Gale, Stowe | 17, | 23 | 3 | Nov. 26, | 29 | 1 | | | | | | |
| L. A. Barrows, Stowe | 17, | 15 | 15 | Jan. 7, 1897 | 17 | 3 | | | | | | |
| C. F. Waterhouse, Windsor | 6, | 19 | 15 | Nov. 7, 1896 | 13 | 2 | | | | | | |
| *Clogston Bros., Williamstown | April 29, | 57 | 28 | Nov. 26, | 40 | 1 | Dec. 30, 1896 | 1 | 1 | May 4, 1897 | 2 | 1 |
| George Wilkins, Stowe | May 4, | 13 | 4 | Feb. 17, 1897 | 9 | 1 | | | | | | |
| Alvin Wilkins, Stowe | 11, | 22 | 10 | Nov. 19, 1896 | 19 | 6 | May 14, 1897 | 13 | 1 | Jan. 9, 1898 | 20 | |
| G. A. Harris, Stowe | 11, | 17 | 6 | Nov. 18, 1897 | 19 | 2 | | | | | | |
| George S. Hutchinson, Randolph | Dec. 18, | 22 | 15 | Jan. 4, 1897 | 4 | 1 | Oct. 15, | 8 | | | | |
| Marcus Peck, Brookfield | Jan. 6, 1897 | 43 | 12 | April 20, 1897 | 10 | 2 | Nov. 18, | 32 | 2 | | | |
| D. H. Flint, Randolph | 26, | 27 | 1 | Jan. 3, 1898 | 19 | 1 | | | | | | |
| T. S. Hackett, South Randolph | Feb. 24, | 24 | 10 | Nov. 30, 1897 | 21 | 1 | | | | | | |
| A. A. Kneeland, Waitsfield | 16, | 21 | 14 | Oct. 22, | 12 | 1 | | | | | | |
| Ernest Hitchcock, Pittsford | March 6, | 46 | 4 | 14, | 39 | 1 | | | | | | |
| H. M. Gibson, East Ryegate | 8, | 67 | 10 | May 5, | 21 | 7 | Nov. | 60 | 13 | Feb. 10. 1898 | 46 | 3 |
| C. H. Whitcher, Albany | Feb. 4, | 34 | 3 | April 7, | 10 | 1 | Dec. 9, | 40 | | | | |
| Robert Anderson, Craftsbury | April 3, | 53 | 5 | Dec. | 45 | 4 | | | | | | |
| George C. Bean, Coventry | May 10, | 41 | 26 | Nov. 10, | 1 | 1 | Dec. 27, | 23 | 5 | | | |
| S. R. Lathe, Craftsbury | 10, | 15 | 4 | Dec. 21, | 10 | 1 | | | | | | |
| W. H. Hayden, Albany | June 12, | 53 | 33 | 6, | 50 | 6 | | | | | | |
| William Richmond, Newport | 12, | 42 | 11 | Nov. | 1 | 1 | | | | | | |
| Ralph Bowley, Coventry | July 26, | 22 | 18 | March 7, 1898 | 23 | 8 | | | | | | |
| George Dow, Cabot | 26, | 33 | 24 | Dec. 15, 1897 | 7 | 3 | May 11, 1898 | 30 | 1 | | | |
| B. S. Gallup, W. Charleston | Oct. 12, | 23 | 9 | Nov. 18, | 9 | 1 | | | | | | |
| C. C. Sheldon East Highgate | Jan. 8, 1898 | 41 | 7 | July 5, 1898 | 25 | 2 | | | | | | |

*August 17, 1897, Tested 6, Killed 4. October 6, 1897, Tested 43, Killed 29.

CATTLE TESTED.

| Name. Address. | Date. | 1st Test. | Killed. | Date. | 2d Test. | Killed. | Date. | 3d Test. | Killed. | Date. | 4th Test. | Killed. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W. C. Whipple, North Pomfret...... | Oct. 26, 1896 | 38 | 10 | Aug. 11, 1897 | 20 | | | | | | | |
| George Cochrane, Ryegate............ | August. 1897 | 55 | 12 | Jan. 21, 1898 | 43 | | | | | | | |
| W. L. Seymour, Randolph Center.. | March 6, 1896 | 32 | 21 | May, 1896 | 11 | | Nov. 11, 1897 | 26 | | | | |
| Jackson Sargeant, Stowe............... | Nov. 18, | 13 | 5 | Nov. 15, 1897 | 11 | | | | | | | |
| C. F. Smith, Morrisville............... | Sept. 1895 | 54 | 1 | Feb. 12, | 42 | 1 | | | | | | |
| J. G. McCollough, No. Bennington | April 24, 1896 | 17 | 1 | Dec. 18, | 21 | | | | | | | |
| C. J. Thomas, Morristown............ | Mar. 5, | 17 | 1 | April 22, | 18 | 3 | Jan. 5, 1898 | 17 | | | | |
| E. L. Bass, Rondolph.................... | Nov. 12, 1895 | 18 | 3 | March 2, | 21 | | | | | | | |
| Luke C. Fisher, Cabot.................. | Map 22, 1896 | 40 | 2 | Sept. 21, | 39 | | | | | | | |
| J. E. Crossett, Waterbury............ | Oct. 10, 1895 | 26 | 2 | Dec. 10, | 40 | | | | | | | |
| George H. Temple, Randolph Ctr... | Nov. 22, | 16 | 4 | Jan. 13, | 20 | | | | | | | |
| George Panton, Brookfield........... | 13, | 32 | 3 | | 43 | | | | | | | |
| E. J. Wheeler, Randolph.............. | Dec. 4, | 9 | 2 | | 10 | | | | | | | |
| Calvin Brewster, Randolph........... | 16, | 13 | 4 | June 20, | 15 | | | | | | | |
| E. B. Cobb, Stowe......................... | Feb. 12, 1896 | 30 | 13 | Nov. 11, 1896 | 34 | | | | | | | |
| George H. Osgood, East Randolph. | March 4, | 27 | 3 | | 18 | | | | | | | |
| F. C. Williams, Coventry.............. | 27, | 15 | 9 | April 4, 1897 | 12 | | | | | | | |
| J. M. Stone, Williamstown............ | May 28, | 26 | 4 | Dec. 30, | 30 | 2 | Oct. 19, 1897 | 30 | | | | |
| George L. Spear, Braintree............ | Nov. 26, | 30 | 3 | Feb. 10, 1898 | 29 | | | | | | | |
| Spencer Howley, Vergennes.......... | 26, | 21 | 14 | April 27, 1897 | 8 | | | | | | | |
| George Tarbell, Braintree.............. | Jan. 6, 1897 | 23 | 2 | Mar. 11, 1898 | 20 | | | | | | | |
| N. Richards, Vergennes............... | 12, | 23 | 1 | April 27, 1897 | 22 | | | | | | | |
| Insane Asylum Farm, Waterbury... | Dec. 18, 1896 | 81 | 5 | 29, | 73 | | Nov. 27, | 72 | | | | |
| C. A. Webster, Randolph.............. | Feb. 8, 1897 | 31 | 2 | June 11, 1898 | 17 | | | | | | | |
| D. C. Blanchard, West Brookfield.. | April 8, | 21 | 2 | Sept. 17, 1897 | 14 | | | | | | | |
| J. J. Pratt, Braintree..................... | June 7, | 10 | 3 | June 3, 1897 | 4 | | | | | | | |

Of the list of 78 re-tested herds here given in which tuberculous animals were found on the first test, twenty-three herds were found free from disease on the second test, and twenty-three herds had only one case of disease each on the second test. Eight of the remaining herds that were found diseased on second test were found free from disease on the third test. Several of the herds have not yet been tested the third time,in which a test should be made in order to feel that the work has been thorough and the last diseased animal removed. In the herds of Marvin Clark and Marvin Chapman of Williston, Clogston Bros. of Williamstown and M. H. Gibson of East Ryegate the disease has been obstinate and repeated tests have continued to find diseased animals. This has been caused in each case by improper disinfection of the stables. At the present time, I believe, each of these herds is practically free from disease and further tests will be made until we feel sure the last case has been removed. The Clogston herd especially deserves mention. As will be noted from the foregoing list, the first test was made April 29, 1896, and twenty-eight out of fifty-seven animals were slaughtered. Cattle were brought in to replace those killed and all were tested before coming into the herd. In November 1896 the herd was re-tested and one was killed. During December another animal was killed. In May 1897 two animals were tested that were suspected and one killed. In August 1897 six head were tested from one end of the stable and four were found diseased. This convinced the owners and commissioners that all should be re-tested and a re-test was made October 6, and twenty-nine out of forty-three were condemned and killed. Cattle that had come to this farm sixteen months before from healthy herds and had passed the tuberculin test were found in the advanced stages of the disease. After this test the owners disposed of the remainder of their stock that had passed the test and shut up their barn until the present time. After thorough renovating and disinfecting, they expect to occupy it again next winter. There is no reason to doubt but the losses following the

first test were caused by the germs of disease in their stables. It is an impossibility to free a herd from tuberculosis without destroying the germs of the disease in the stables they are to occupy, and we might further add that proper disinfection is a far more difficult matter than is the discovery of the diseased animals. From the average of results secured our Board believes that every day of delay in removing diseased animals from a herd is likely to add something to the expense of suppressing the disease.

### SANITARY CONDITIONS.

There is little or nothing to add or retract from what has been said in previous reports under this head. There is no evidence to show that any sanitary conditions will check the disease in an animal after it has once become diseased, but it is true that a good sanitary condition is a powerful factor in checking the spread of disease and too much emphasis cannot be placed upon its importance. Good ventilation and abundant sunlight in the stables will prove the best investment the stock owner can make both for the protection it will afford to the health of the herd and for the better returns they will give for the food supplied.

### CURATIVE AGENTS.

All persons interested in bovine tuberculosis either as owners of stock or as officials interested in controlling the disease are watching and hoping that some remedy will be found that will cure the disease but the past year has added nothing to our knowledge in this direction.

### THE TUBERCULIN TEST.

The value, reliability and harmless character of this test has become so well known that further discussion of this topic seems uncalled for. To-day it is only those who know little or nothing of the subject that have any doubts as to its high value as a diagnostic agent for tuberculosis. Many of the claims first made in

regard to the difficulty of its being used except by veterinary physicians are found to be without foundation. Much of the prejudice that has been engendered against the test has come because people felt that it was being advocated for selfish purposes, and the business of the veterinary of testing cattle at from two to five dollars per head gave a good deal of probability to such opinions. The use of the test is a simple matter and any intelligent person can learn to apply it properly to his own herd in a very short time. It is not more difficult to use than the Babcock test for milk and like it needs simply care in its execution. There is no good reason why stock owners should not learn to use this test themselves and never buy stock that is not sound. While not wishing to convey the idea that no scientific knowledge of disease is useful in connection with the use of this test, we believe the knowledge necessary to use and interpret the test with a fair degree of accuracy is not beyond the reach of the intelligent stock owner, and the difficulty attending its proper application has been largely overstated. Acting upon these convictions, we have authorized the testing of a good many cattle during the past year by members of the Board. Mr. Williams and Mr. Ware have each tested a large number of animals. The work done by these members has been as free from mistakes as that of any of the veterinaries employed. In the following statement of expenses for this work probably two-thirds of the amount received by Messrs. Williams and Ware was for testing cattle and not for superintending the work of others.

### MISTAKES OF THE PAST YEAR.

During the past year the State has had to pay full price for twelve of the animals killed. Most of these were probably diseased but not sufficiently to show lesions that were satisfactory to the owners, or such as were conclusive to the members of the Board having the work in charge. As in the past we have felt it to be the better policy to give the owner of the stock the benefit of any reasonable doubt that might arise.

### QUARANTINE.

The same quarantine restrictions have been maintained the last year as in the past. No case of diseased animals being admitted to the State has come to our knowledge, and there have come to us but few complaints of violation of the order. In one case where it appeared that the order had been purposely ignored a small fine was collected of the party, enough to cover expense incurred in looking up the case and to remind the person that the order was intended to be obeyed. Quarantine regulations are in many respects inconvenient to stock owners and dealers but they are a necessity in connection with any effort to control disease among our cattle. Evidence of this has come to us in many instances during the past year. We have found that cattle buyers from States where no quarantine was in force have purchased many suspected animals, at a price a little less than would have been paid if not suspected. While we have endeavored to have all work done on cattle going to States where a quarantine was in force, performed with the same care and under the same rules as State work and have demanded that all animals found diseased be turned over to us for slaughter, we have not felt it to be our duty to try and protect the interests of States that had no protection of their own. We have not, however, allowed cattle that have been condemned to go out of the State.

### LEGISLATION.

Your Board is not disposed to suggest any important changes in our present law. Demands come to us asking for full compensation for cattle killed; that the test be made compulsory, that all cattle in the State be tested and for various other changes that do not commend themselves to us. The only changes we should feel disposed to approve would be to extend to the Board authority to test and dispose of diseased animals in herds where disease was practically known to exist, also authority to re-test in herds where disease has been found. These changes would facilitate the work somewhat. Under our present system I do not

know of over a dozen herds that we have reason to know to be diseased that have not consented to a test, and it is not a bad policy to leave undisturbed any law that is fairly acceptable.

### THE WORK OF THE PAST YEAR.

For the past year the work of testing cattle has been largely in Orleans, Caledonia and Windham Counties, with more or less work in all portions of the State. Quite a number of bad herds were found in the localities mentioned and the cleaning up of these herds led to a demand for quite a general test of the herds in the locality. At the present time the sections in which disease has been found are very generally tested, and as we believe quite free from tuberculosis. As less than twenty per cent of the cattle in the State have been tested, it is quite probable that other sections will be found in which tuberculosis is plentiful. As the farmers are to-day quite watchful of their herds and very free to call for inspection when any doubt arises, we believe that most of the badly infected sections have been tested and that the work in the future is likely to show a less per cent. of diseased cattle than the work already done. Quite a demand has been made on the Board by creamery proprietors to have all the herds supplying milk to their creameries tested, and such requests have been granted. A list of all herds tested of ten animals or more will be printed in a pamphlet in connection with this report ; this pamphlet will be sent to any person applying for it.

### GOVERNMENT AID.

As in the past the Bureau of Animal Industry has continued to supply tuberculin free of expense to the State. This has been a large saving to the State. Even at the reduced price at which tuberculin is sold, what has been used by our Board would have cost in the market from six to seven thousand dollars.

## ANTHRAX AND BLACKLEG.

During the year one herd of cattle has been vaccinated for Anthrax and one for Black Leg. Two other applications for vaccination for Black Leg are awaiting action.

## GLANDERS.

One case of glanders has been found during the year. Several other tests for glanders have been made but the cases did not prove to be glanders.

# EXPENSES OF CATTLE COMMISSIONERS.

MEMBERS OF BOARD.

| | | |
|---|---|---|
| V. I. Spear. | | |
| Services | $519 00 | |
| Assistant | 177 50 | |
| Expenses | 448 89 | |
| | $ | 1,145 39 |
| F. C. Williams. | | |
| Services | $384 00 | |
| Expenses | 155 90 | |
| | $ | 539 90 |
| J. H. Ware. | | |
| Services | $368 00 | |
| Expenses | 140 03 | |
| | $ | 508 03 |
| J. K. Curtis. | | |
| Services | $ 67 50 | |
| Expenses | 7 72 | |
| | $ | 75 22 |
| J. O. Sanford. | | |
| Services and expenses | | $8 13 |
| C. J. Bell. | | |
| Services | $ 74 00 | |
| Expenses | 15 74 | |
| | $ | 89 74 |
| Total expense of Members of Board | | $2,366 41 |

VETERINARIES.

| | | |
|---|---|---|
| F. A. Rich. | | |
| Services | $ 433 00 | |
| Expenses | 107 05 | |
| | | $ 540 05 |
| John Thomas. | | |
| Services | $ 437 50 | |
| Expenses | 9 60 | |
| | | $ 447 10 |

| | | |
|---|---|---|
| **H. Phillipsen.** | | |
| Services | $ 22 00 | |
| Expenses | 4 37 | |
| | | $ 26 37 |
| **C. A. Prouty.** | | |
| Services | | $ 29 50 |
| **H. Buss.** | | |
| Services | $ 67 50 | |
| Expenses | 11 62 | |
| | | $ 79 12 |
| **E. W. Culley.** | | |
| Services | $ 702 00 | |
| Expenses | 68 91 | |
| | | $ 770 91 |
| **J. C. Parker.** | | |
| Services | | $8 00 |
| **H. W. Burgess.** | | |
| Services and Expenses | | 22 85 |
| **Robt. Weir.** | | |
| Services | $ 35 00 | |
| Expenses | 10 45 | |
| | | $45 45 |
| **J. S. Dutton.** | | |
| Services | $ 148 50 | |
| Expenses | 21 39 | |
| | | $ 169 89 |
| **L. C. Wakefield.** | | |
| Services | $ 773 00 | |
| Expenses | 82 40 | |
| | | $855 40 |
| **A. W. Gorham.** | | |
| Services | $ 305 00 | |
| Expenses | 12 20 | |
| | | $ 317 20 |
| **C. L. Morrin.** | | |
| Services and expenses | | $ 47 75 |
| **A. B. Gay.** | | |
| Services | $ 470 50 | |
| Expenses | 38 47 | |
| | | $ 508 97 |

| | | |
|---|---|---|
| George Stephens. | | |
| Services | $50 00 | |
| Expenses | 4 16 | |
| | | $54 16 |
| C. W. Fisher. | | |
| Services | $ 157 00 | |
| Expenses | 3 41 | |
| | | $ 160 41 |
| Total expense of Veterinaries | | 4,083 13 |

SUMMARY OF WORK AND EXPENSES OF CATTLE COMMISSION.

| | | |
|---|---|---|
| No. tested in herds of ten or over | 19,075 | |
| " " " " for drovers | 4,750 | |
| " " small herds of less than ten animals each | 3,434 | |
| Total number tested | | 27,259 |
| No. killed in herds of over ten | 684 | |
| " " " small herds | 168 | |
| " " " for drovers | 20 | |
| Total killed | | 872 |
| Paid for cattle killed in herds of over 10 | $10,599 50 | |
| " for cattle killed in small herds | 2,565 25 | |
| " for cattle killed for drovers | 329 25 | |
| Total paid for cattle | | $13,494 00 |
| Paid Veterinaries | | 4,083 13 |
| " Members of Board | | 2,366 41 |
| " for one glandered horse | | 30 00 |
| Total expenes of Cattle Commission | | $19,973 54 |
| Average per cent. of diseased cattle | | 3.2 |
| Average cost of testing per head | | 21 cents. |
| Average price paid for cattle killed | | $16 62 |

V. I. SPEAR,

Secretary

# INDEX.

# REPORT

—OF THE—

# Twenty-Eighth Annual Meeting

—OF THE—

# VERMONT

# Dairymen's Association.

1898.

EDITED BY

**G. W. PIERCE, Secretary.**


BURLINGTON:
FREE PRESS ASSOCIATION,
PRINTERS, BINDERS AND STATIONERS

# OFFICERS

—OF THE—

# Vermont Dairymen's Association.

# 1898.

PRESIDENT.

C. F. SMITH .................................... Morrisville

VICE-PRESIDENTS.

H. W. WALKER ................................ Woodstock
W. M. CLARK ................................... Williston

SECRETARY.

G. W. PIERCE .................................. Brattleboro

TREASURER.

H. W. VAIL .................................. North Pomfret

AUDITOR.

GEORGE AITKIN ............................. Woodstock

## An Act to Promote the Dairy Interests of Vermont.

*It is hereby enacted by the General Assembly of the State of Vermont:*

SECTION 1. The sum of one thousand dollars is hereby appropriated annually to the Vermont Dairymen's Association, for the purpose of promoting, developing and encouraging the dairy interests of the State.

The Auditor of Accounts is hereby directed to draw an order on the State Treasurer in favor of the Treasurer of the Vermont Dairymen's Association, for the first payment of this appropriation, on the first day of January, A. D., 1889, and annually thereafter so long as the conditions hereinafter provided shall be complied with.

SEC. 2. Said Vermont Dairymen's Association shall hold an annual meeting, continuing for at least three days, at some town or city in this State of easy access to the people, and in some comfortable and convenient building; and said meeting shall be open and free to the people of the State. At said meeting, the best available talent in the country shall be employed to teach and discuss the best methods of dairy farming, and subjects connected therewith; and at said annual meeting, premiums shall be offered for the best dairy products of butter and cheese, to an amount of at least two hundred dollars; such premiums to be awarded by disinterested and expert judges, and paid by the treasurer of said Vermont Dairymen's Association.

SEC. 4. The Secretary of said Vermont Dairymen's Association shall, on or before December 1, 1889, and annually thereafter, make a detailed and itemized account to the State Auditor of accounts of the receipts and expenses of said Association, which accounts shall be approved and countersigned by the Treasurer and Auditor of said Association.

SEC. 5. If, in any year, it shall appear to the State Auditor of Accounts that any part of the preceding annual appropriation remains unexpended, or has not been honestly or judiciously expended, then such a part or amount shall be deducted from the order for the next succeeding annual appropriation.

SEC. 6. This act shall take effect from its passage.

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## An Act to Provide for the Printing of the Report of the Vermont Dairymen's Association.

*It is hereby enacted by the General Assembly of the State of Vermont:*

SECTION 1. Section two hundred and forty-seven of the Vermont Statutes shall be amended so as to read as follows:

The Secretary (of Board of Agriculture) shall prepare on or before the 30th day of June annually, a detailed report of the proceedings of the Board with such suggestions in regard to its duties and the advancement of the interests herein specified as may seem pertinent, and he may append thereto such abstracts of the proceedings of the several agricultural societies, and farmers' clubs in the State as may be advisable and the report of the Vermont Dairymen's Association. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

SEC. 2. The provision of Section two hundred and fifty-one of Vermont Statues requiring the printing of a report by the Vermont Dairymen's Association is hereby repealed.

Approved November 4, 1896.

## CONSTITUTION.

SECTION 1. This organization shall be called the "Vermont Dairymen's Association."

SEC. 2. Its object shall be to improve the dairy interests of Vermont, and all subsidiary interests.

SEC. 3. This Association shall consist of such persons as shall signify their desire to become members, and pay the sum of one dollar, and a like sum annually thereafter, and of honorary and corresponding members.

SEC. 4. The payment of five dollars shall constitute a life membership, or the payment of an annual membership fee of one dollar for five consecutive years, shall constitute a life member.

SEC. 5. The officers of the Association shall be a President, two Vice-Presidents (one from each Congressional District), a Secretary, Treasurer and an Auditor, who shall constitute the Executive Committee, and have the general oversight of all the affairs of the Association.

SEC. 6. There shall be held, during each winter, an Annual Meeting, at such time and place as the Executive Committee may designate, for addresses, discussions, exhibitions, and the election of officers, who shall hold their respective offices for one year, or until their successors are chosen. Said meeting shall continue in session at least three days.

SEC. 7. It shall be the duty of the Secretary to prepare an Annual Report of the transactions of the Association for the current year, embracing such papers, original or selected, as may be approved by the Executive Committee, and cause the same to be published and distributed to the Dairymen of the State of Vermont.

SEC. 8. The Treasurer shall keep the funds of the Association and disburse them on the order of the President or Vice-President, countersigned by the Secretary, and shall make a report of the receipts and expenditures to the Annual Meeting.

SEC. 9. This constitution may be amended at any Annual Meeting by a two-thirds vote of all the members present.

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# REPORT

OF THE

## TWENTY-EIGHTH ANNUAL MEETING

OF THE

# VERMONT DAIRYMEN'S ASSOCIATION,

HELD AT

ST. ALBANS, January 4, 5, 6, 1898.

The meeting was called to order Tuesday morning by the President, C. F. Smith of Morrisville.

Rev. L. O. Sherburne invoked divine blessing. A cordial welcome was extended to the Association by Mayor Fuller C. Smith, in behalf of the citizens of St. Albans, which was responded to by Hon. H. W. Walker of Woodstock, first Vice-President of the Association.

### ADDRESS OF PRESIDENT SMITH.

*Members of the Vermont Dairymen's Association, Ladies and Gentlemen :*

I consider it a distinguished privilege to greet you on this occasion. Well do I remember the first time I ever attended a meeting of this Association. I was hungering and thirsting for dairy knowledge, but did not even dare to make an *attempt* to ask a question. We should be very thankful that He who guides and guards us will permit so many of us to meet on this, the twenty-eighth anniversary of our Association. As we form new acquaintances, and renew old ones, our hearts are made sad by the thought that we shall not see one, who in past years, we have learned to love and respect for his kind words and

Christian spirit. But our loss is his gain. One of the Vice-Presidents of this Association has gone to his reward. Though quiet and modest, he helped others for the sake of doing good. We mourn him as a friend as true as God makes men.

We are pleased to meet as an Association with this hospitable people, in this beautiful hall, situated in the best dairy town in the county, and the best dairy county in the State, where is located the famous Franklin County Creamery, the largest in the world. At this creamery the product of more than 20,000 cows is manufactured into butter and shipped to market in tubs, boxes and prints where it commands the highest market price. We meet to compare notes and discuss matters of interest, striving to improve ourselves and elevate our calling by studying our occupation and advancing the same so as to keep in the front rank. There is no stopping point. We must constantly agitate these problems which pertain to the dairy. The greatest problems which confront us must be wrought out through the mind. Education is beginning to have a new meaning in the world. It means a training in those things which the world needs, whether to think, to know, or to do. With this education labor is becoming more respected, if it be good labor and directed to a worthy end. There should be no distinction between thinkers and workers. Some one has said the best fertilizer for our farms was muscle. We have been taught to feed balanced rations to our cows and balanced fertilizers to our soil. We need well-trained minds together with muscle to make a balanced material to apply to Mother Earth. With these the farmer's success is assured. Favorable soils and climatic conditions are other very necessary elements to successful dairying. Vermont possesses these natural conditions to a remarkable degree. Milk production, or dairying, is the great industry with Vermont farmers. How we can lessen the cost of production is a question of vital importance. We must raise the standard of our cows. The first thing necessary to do to accomplish this is to raise the standard of our men. This condition, which makes mental growth a necessity to drive

poverty from our homes, may be one of the greatest blessings of our times. When we are capable of taking this machine, the cow, and so mould and fashion it, that we can produce ten thousand pounds of milk yearly, or five hundred pounds of butter, will we not be able to drink in more of nature's laws and live closer to nature's God. While breeds, blood and pedigrees are important factors, individual merit or structure is of paramount importance.

Another way to lessen the cost of production is to feed a more economical and a better balanced ration. To become successful in this requires study, thought, intelligence. We must study what crops to raise and how to secure them to make them the most palatable and contain the most nutrients. As a rule the world pays for what it gets. Our success as lawyers, doctors, merchants, mechanics, or farmers will be in proportion to the study, intelligence and effort we put into our work. But there is no occupation that affords so much freedom and independence and enables us to live so near nature, nature's laws, and nature's God as farming. Cromwell's son, Richard, chose the life of a farmer rather than govern England.

## CHEESE.

A few years ago the United States sent $13,000,000 worth of cheese to England, and Canada $3,000,000 worth. Our government has allowed filled cheese, oleomargarine and various other frauds to be made and sold for what they were not, while the Canadian government said, "Make not, touch not, sell not the unclean thing." As a result in ten years we have changed places with Canada. Can we, and will we try to redeem our reputation in the next ten years. It pays to be honest as well for a nation, or a state, as for an individual. Vermont is not a large cheese producing State, yet there is no reason why it could not be made as remunerative here as in other States. In our judgment, the right thing to do is to make the kind of cheese that brings the highest price in the English market. To do this,

and to make a success for us as a State, we should get an expert instructor in the art of cheese making and let him go from one factory to another and teach our cheese makers and have general oversight of them. We believe this would mean thousands of dollars to the patrons of cheese factories.

### SECRETARY OF AGRICULTURE.

It is very important to the agricultural interests of this country that the Department of Agriculture be placed in the hands of a person of high character, great intelligence, large experience and wide acquaintance—one who has a knowledge of public affairs and is intimate with the various interests connected with agricultural pursuits. This office calls for a man who has made this great industry a study and recognizes its importance, in its economic relations, all the way from the soil to the sale of our surplus abroad. Such a man was found in James Wilson of Iowa.

One of the most important questions now confronting the dairy industry is how to get rid of our surplus at prices that will give us a reasonable profit from its production. To Great Britain we must look for a market for our surplus butter and cheese. Her people consume about 500,000,000 pounds of butter per year, while her home production is only about 200,000,000 pounds, leaving 300,000,000 pounds to be supplied by other countries.

A few years ago we had a fairly good reputation in the English market for producing good butter and cheese, but imitation butter, filled cheese, together with exporting our poorer grades of butter, have placed us at a disadvantage with other countries; our butter being prejudiced against, in the English market, as States butter. As a result of this, less than 1 per cent. of $65,000,000 paid by Great Britain for butter comes to the United States. Secretary Wilson is endeavoring to overcome this prejudice by having some of the best American butter put up in various styled packages to suit the English market and shipped there by the best refrigerator accommodations.

This butter was well received by the dealers there, most of them pronouncing it as good as any from Denmark, France, or Australia. We are sorry to learn that none of the consumers knew this butter came from the United States. If the policy adopted by the Department of Agriculture is continued, as we believe it will be, in a few years we will have redeemed our reputation, our butter will be in demand by both dealers and consumers, and a market for our surplus secured.

### AGRICULTURE IN COUNTRY SCHOOLS.

Cultivation of the soil with its allied branches of farm economy is the main sources of the nation's wealth. Nearly fifty per cent. of the population of this country are engaged in agricultural pursuits. In our State the per cent. is much larger. But very few of this large number who deal with nature know the first principles of nature's laws.

A man to be a successful engineer must know all about his engine. He must understand thoroughly just how it is made and how it is operated. To be a successful surgeon requires years of study to acquaint one's self with all parts of the human body. How can a farmer become skillful and perfect in his work if he knows nothing about the origin, formation and classification of soils, the constituents of plants and plant growth, or the principles of breeding and feeding stock? It is in our country schools that such education should begin. It is only in these schools that the great mass of farmers can be reached, as they do not attend the higher schools. It is acknowledged to-day that agriculture is the foundation interest of our country, and that as it is depressed or prosperous other business will be depressed or accelerated. To the boys and girls of the country we must look for the future prosperity of agriculture and the welfare of the State. We are well supplied with educated lawyers and professional men, but lack educated tillers of the soil. Nature studies and the various sciences pertaining to agriculture have been engaging the minds of some of the brightest men among our professors for several years. The time has come when it

should be brought within the reach of the common farmer. If we place a course of agriculture in the schools of the rural districts, it will be of untold value, not only to those who attend the country schools alone, but it will create a desire for a higher course in agriculture.

We have a model State Agricultural College supplied with laboratories and all up-to-date apparatus; but there is one very essential element lacking that will have to be supplied before our state reaps great harvests from it, and that is students. We know we are treading upon dangerous ground, but we do not expect to see the millennium in our Agricultural College until it is severed from all connection with any other institution and stands out clearly and distinctly by itself and offers the same inducements to our girls as it does to our boys. Farm life demands on the part of women as well as men, a special culture and training in the scientific and practical problems of life. The same chemical instruction which enables a man to analyze milk or compound feed rations for his stock would enable his wife to detect adulterations in food for the table. Our State has spent hundreds of dollars in experiments to instruct our farmers how to prepare a balanced ration for their dairy cows, and at the same time it is filled with homes where the cooks do not know how to prepare an economical and well balanced ration for our boys and girls. Minnesota is taking the lead in offering to her daughters the same advantages, in her school of Agriculture, that her sons receive. If we could have one hundred farmer boys and as many girls graduated from our Agricultural College every year, its success would be assured and our state would soon make such rapid strides in agriculture as to place it at the head of the Union. In looking over the list of suujects now taught in our common schools, the tendency is to direct the mind toward literature and the professions, and cause a dislike for the commoner walks of life. Our scholars should be instructed in those subjects with which a majority of them will have to be identified all their lives. With nature studies and the science of agriculture taught in our common

schools, farm life would be invested with new interest, and the general sentiment held in regard to it would be uplifted. In this and other states, too many of our brightest and most energetic boys and girls are leaving the farm and drifting into other occupations. With the science of agriculture in our schools, many of these would acquire so much interest and enthusiasm in its study that they would put all their intelligence and ambition into the improvement of farms and the building of good farm homes. Our national existence has its foundation in the home filled with happy people. It is time for serious thought on this matter. Our boys and girls should be educated towards the farm, where they can make for themselves a home and a place in society. Where shall this education begin, and how shall it be brought about? First it must begin in the minds of the farmers, who are the parties most interested, and who have it in their power to control the rural districts. There is a lack of interest on the part of parents in our country schools that should be corrected. This subject should be agitated and brought before the people in Grange meetings, Institutes and all farmers' gatherings. Our State Superintendent of Education should see that nature studies and the science of agriculture are taught in our summer schools for teachers, and in our State Normal schools where special instruction in teaching is given. Teachers should be required to pass an examination in this as in other branches, and it should be made a regular branch of study. We shall not lack for proper text books. Several have been prepared to meet this growing want, and others are in process of construction.

### INTENSIVE FARMING.

Vermont has had too much of extensive farming. What we as farmers need is not more acres, but more thinking to the acre. We need good sound judgment, more and better directed labor and less waste of fertility and muscle. We need to keep abreast with the times. Old methods followed by our father will give us no profit in these times of low prices and sharp

competition. Many of our farmers will not keep as much stock now as formerly. Why is it that in some of our Western dairy States the price of land has been advancing, while ours is decreasing? Is it not because they are making rapid strides in dairy intelligence? Is it not because they have been keeping abreast of the times, while we have keeping along in the old ruts? We, as well as manufacturers and other business men, must keep up with the times, or go under. In the State of Wisconsin, since the organization of their Dairymen's Association, twenty-five years ago, their annual dairy products have increased from one million dollars to thirty-two million dollars. The farmers of Wisconsin built thousands of silos, while those of the East were discussing their merits. In a series of carefully conducted experiments at the New Jersey Experiment Station, a field of corn producing eleven tons of green corn to the acre was found to be worth ten dollars an acre more for milk production when made into ensilage than when dried. We must study to produce milk at a less cost, so the margin will be on the right side. The Island of Jersey, from which came the most famous cows of the world, is a good illustration of intensive farming. It is about fourteen miles long by four to seven miles wide, and contains about 10,000 acres. It has a population of 60,000 with 30,000 to 40,000 visitors annually. According to the last census there were on the island 11,891 Jerseys and 2343 farm horses, an average of nearly one and a half head per acre. Their farms average about eight acres, upon which are kept eight to ten cattle and two to four horses. Five acres will be devoted to early potatoes, followed by roots the same year. The other three acres will be devoted to clovers and soiling crops. These farmers support themselves, live comfortably, largely feed their own population, varying from 70,000 to 90,000, and export from three to four million dollars worth of vegetables annually. They raise from five to six hundred bushels of potatoes per acre. Farming land there is said to be worth $1500 an acre. According to government statistics, Vermont had on Jan. 1st, 1897, 263,640 cows, an average of 4½ cows to

each one hundred acres, or an average of 8⅓ head to each one hundred acres, including horses and cattle of all ages. These figures, according to the statistics gathered by our State Board of Agriculture, are a little too large, but they are small enough when compared with the 150 head kept to each one hundred acres on the Island of Jersey. They have no waste land and their climate is different from ours, yet this illustrates something of the possibilities of the soil with intensive farming.

Have we not been robbing the soil of its wealth of nutriment, and are we not leaving it sterile, barren and unproductive? Are we not allowing that which nature intended to supply the fertility to our soil to pollute the air we breath, by standing in cesspools about our drains and barn yards; and our water to be poisoned with germs of disease, thus inviting fevers, misery and death? The question of proper drainage and fertilization is of permanent interest to every farmer and dairyman in Vermont.

The omnipotent power of nature will not bless man with liberal harvests if he robs her of her riches, but let him return to her the discolored waters which we scorn, and our stock refuse to taste, and she will fill our cellars with luscious fruit and our storehouses with golden grain. Dairying removes from the farm the smallest amount of plant food of any branch of husbandry. By buying from the Western States bran, linseed, cottonseed, etc., feeds rich in protein, to give us a well balanced ration for our milched cows, our farms should increase in productiveness year by year. With the thousands of dollars worth of plant food, which are now annually wasted, all saved, this course would soon give us the richest soil of any State in the Union. We would be the garden of Eden, Mother Earth would bestow her blessings upon us and give us an abundance to fill the hungry mouths of millions.

## DEMAND FOR DAIRY CATTLE.

Is dairying in danger of being overdone? When we look at some of the Western States and see their rapid increase in dairy products we may be led to think so at first thought. Statis-

tics show that in 1890 there were in this country 264 cows to each 1000 inhabitants. Up to that date the increase in cows nearly kept pace with the population. The statistics for January, 1897, place the number of cows at 228 to each 1000 inhabitants. In our cities people are consuming more milk per capita, while the rapidly growing demand for cream is surprising. In New York City alone there were consumed 9,000,000 quarts of cream in 1896. Some of this came from a distance of 300 miles. Nearly all of our New England cities are using as much proportionly. Maine is shipping large amounts of cream to Massachusetts. There has been an increasing demand from the States south of us for our dairy stock at very remunerative prices. This demand is likely to increase owing to the greater demand for milk and cream in the cities of Massachusetts and Connecticut, where, owing to their location, they cannot as well afford to raise their cows. Vermont should also largely increase her dairies. With this strong demand for good cows and with "The better the cow the better the price," the Vermont farmers should get the best sires possible from some of the dairy breeds and raise their heifer calves. There will be a demand for them, and the demand will grow better year by year. Again, I say breed and raise the best heifer calves possible.

### STATE INSPECTION OF CATTLE FOODS.

Feeding stuffs of the same kind vary largely in composition, so that a given specimen may contain a large or small amount of nutrients. This makes it possible for a given food material to be fed with large profits in one case and with equally large loss in another. We not only pay for what we do not get, but suffer loss from not feeding a well balanced ration, and are in danger of injuring our animals. Prof. Woods, Director of the Maine Experiment Station, analyzed two samples of cottonseed meal, one of which had 22 per cent. of protein in it and the other 53. Our Experiment Station has recently analyzed specimens of gluten feed, from our town, in which nearly as marked differences existed. The farmers of Vermont have saved thou-

sands of dollars from the protection against fraud in commercial fertilizers. Would we not also be greatly benefited by a law requiring manufacturers, or dealers, to put the analysis of the different kinds of animal food on the tags or bags. The large number of by-products and mixed feeds, that are now being placed upon the market makes this law a necessity for our own protection.

### THE OUTLOOK.

The business depression is fast passing away. Most of the laborers who have been idle for months are now employed, and consequently more money will be in circulation to spend for dairy products. The filled cheese fraud is practically out of the way and more cheese will be consumed at home and better prospects for securing a foreign market. The anti-color law, as it is being adopted by the different states, is driving oleomargerine from the market. Its manufacturers "die hard" for by being allowed to deceive the people and destroy the markets for our butter, they can amass their millions. The time has come when the American people will submit to it no longer. It is also a hopeful sign when we see dealers in oleo paying fines of $1,000 each, as has been done within the last few months. With the abundant crops of nearly all kinds that have been harvested, with the effort our Government is making to secure a market for our surplus dairy products, with the increasing consumption of milk, cream and butter, and the demand for our dairy cattle, with the lessons we are learning in how to produce at a less cost, we, as Vermont dairymen, have some reasons for encouragement. Vermont seems to be favored among the Eastern States in dealing with the tuberculosis question. The policy adopted by the State, carried out by wise commissioners, has more than met the expectations of its most earnest advocates. The expense has been moderate compared with that of other States. Only 3.2 per cent. of all cattle tested have been found diseased. If the present policy is continued for a few years, we will be practically free from the disease. The

Vermont dairymen should attend the institutes better, read more dairy papers, and make a closer study of their business.

Let us set the standard high in our farm homes. May we be able to keep out all that is unholy and impure. May we have peace of mind, contentment of soul, steadfastness of character, love of Nature and Nature's God, home, kindred, wife and children. These cannot be bought with gold, but are more precious than rubies.

## DAIRYING.

Address by MR. H. E. COOK, of Denmark, N. Y.

*Mr. President, and Members of the Vermont Dairymen's Association:*

Now we want to be very informal and, if possible, get down to the root of the matter. Through an invitation from your Secretary some little time ago, I was requested to come here and make a talk on dairy matters, particularly the butter and cheese business, and by referring to your programme you will see it is laid down somewhat differently, as announced by your President, from the line we will take up.

Before commencing our address proper, I will say that I have looked up somewhat the agriculture of your State and was somewhat surprised to note the position and standing of Vermont as compared with the dairy work of other states in this country. We are very apt to think, in our respective states and respective localities, that we are about all there is of creation, but when we come to get out and see other people working under different conditions, we find that they often feel just the same. I am rather surprised to find that the dairy work in Vermont stands, in so many respects, at the head in this country. I find in number of cows, taken from the census of 1890, to a thousand people, the State of Vermont is second, the State of Iowa being first. Vermont has six hundred and seventy cows per thousand population. The production of these cows gives you the largest production to the square mile of dairy products of any state. That shows well for the intelligence which backs up the breeding and dairy work of the State of Vermont.

I find that in cheese making you were third in production per square mile, while in total output in cheese the State of

Vermont was fifth, while the State of New York stood first. I found that the average production per cow in the State of Vermont had not materially changed since the census of 1860. Not that that shows discredit, but it shows that you have maintained a wonderfully high standing in the last forty years; that in 1860 the cows of this State produced three hundred and eighteen gallons per cow, while in 1890 you had increased that only to three hundred and ninety-two. I think it is well sometimes that we do look over the statistics of our country, as we judge by comparison.

Now just a word; I want to take up this matter, farmers, from the care of the cow along up through to the marketing of the product. It will be necessary to be brief, because each branch of the topic would necessarily cover a full half or three-quarters of an hour if discussed in detail. The care and feeding of the animal is of great importance. In this day success depends largely upon the feeding of the cow and the handling of the product in the market.

The first thing to look at is the cow. I am not trying to advertise any particular breed, for in my mind it does not make so much difference whether they are of the Jersey or some other desirable breed, only that we have a cow of the true dairy type. It is true that in your State there are dairymen who cannot get that old beefy type out of their minds. They are looking at the machine that is not built especially for their demand. I do not know that that is true with you, but it is true in New York state. There is only just one type of animal that is profitable to-day, and it does not make any difference whether they are from the Isle of Jersey, from Holland, or the United States. You will find that the types of the dairy cow are almost exactly alike in their make-up; that it is not so much the breed as it is the type of the breed. I was very much pleased this morning to hear your President cite some facts from the Isle of Jersey. We want to work our dairies up to where they will produce at least 350 pounds of butter. I dare say I am safe in saying there is not a man present in this room who

is prosecuting dairying at a profit unless he is making 250 pounds of butter per cow. A dairyman cannot move in good society in Dealware County, New York, unless his dairy makes 300 pounds of butter per cow. Now if we have got this good cow let us say just a word about her care first, and then later her feed. Too many of us spend too little time in the care of our cows. I believe that goes without saying. A man must have his dairy in his mind's eye just as much as the President of the Delaware & Hudson Railroad Company has the business of that great corporation in his mind, and he cannot succeed unless he does. The development of this cow, taking the little calf from the beginning, its surroundings, its environments, and its care must all be in his mind's eye every day. If he has company, even the President of the United States, he ought to have pride enough so that you would find him in his stable. His cows should be in a room as light as this and everything else should be in comparatively good condition; and about the first thing you will see that gentleman do will be to invite his company in to see his cows. That means dollars and cents, and shows that there is not only a type of dairy cows in that stable, but a type of a dairyman. We have a little machine that will tell the butter fat in the cow's milk, and I believe we ought to have a little machine that will tell the dairy type of the farmer. But the lines that your President discussed this morning are along the line that will bring out that kind of a man.

Now in regard to the food of the cow, that means a great deal. Your President spoke of the balanced ration. I used to think I could take my pencil and paper and figure out a balanced ration for the old cow, but I have changed my mind. I think a good deal of our balanced ration idea, so far as it is drawn from prepared tables, should be thrown to the wind. Because we know the difficulty of adapting feeding tables to the foods we have on the farm and their digestibility, at the same time taking into consideration the individuality of the animals. I do not want any man to come into my stable and tell me what to feed. I have found that if I do not know more about the

demands of my dairy than any one else I am not living up to my possibilities. Do not understand that I am saying one word against it. I believe every man should be familiar with the terms protein, carbo-hydrates, fibre, etc., that he ought to be just as familiar with such terms as he is with wheat bran, and corn meal, and those foods that you have always known. I do not say anything against those foods, but I do speak against a fixed ration for the Vermont cow (when we do not know her individuality or the composition of your home-grown foods), and I believe the time is not far distant when we shall cease to make the balanced ration the point of importance that we do now. But until that time does come I do not see any way to get a correct way of feeding our animals, except as we study the individuality of our cow and feed her accordingly. The protein produces the blood and lean meat, and the carbonaceous matter furnishes heat, energy and fat. Give the cow all the protein she requires, but do not feed that element to produce heat, and feed her gums and starches and sugar, all she can use and keep that machine running. Our ration at the present time contains about one part digestible protein to seven and one-half parts digestible carbo-hydrates.

Now when we come to this point we are on the danger line. Any cow that is receiving more sugar and starch and gum than she can assimilate and digest, is in just the condition toward her owner that any steam boiler is when the engineer has set the safety valve at 40 pounds and she is blowing off 20 pounds of steam. Whenever we get that cow up to the profitable point, then every pound of sugar and gum, and every pound of carbonaceous matter she receives, she is blowing off through the safety valve or else the cow is adding this starchy matter in the form of fat. When you come to the flesh-forming point you are injuring that cow for the production of butter fat. She is simply taking the forces of the food and applying them on her back instead of putting them in the milk-pail where nature intended she should, and where we want them. No man can establish a ration of a given number of pounds of protein and

carbo-hydrate matter unless he knows the individuality of his cows.

Is the silo in general use here?

(A member). No.

Your President told us this morning that Wisconsin was building silos and profiting by them, while New York and Vermont were talking about them. I was reminded by this, very forcibly, of once seeing two fellows at a Fourth of July exhibition. The two parties wanted to catch the greased pig, and while the two fellows were quarreling another fellow caught the pig. Canada has caught the pig in cheese making.

I believe better butter can be made with the silo than without it. Better butter can be made where the animal has some form of succulent food than where she has not. I believe I can tell the product, if other things are equal, if silage has been a part of the ration of the cow. It will be better, and there is no mistake about it; but for pity's sake, and for the old cow's sake, don't put up this old-fashioned sour silage. I have found, particularly in the northern part of our State, silage that was not fit to feed a cow. I hope that you have not that kind in the State of Vermont. We are still making silage in the State of New York that is not fit to feed. It injures the product. I think there is no one here who will not admit that milk can be produced cheaper with silage than without it. I asked Dr. Morris last winter what was the effect of silage on condensed milk product in that section. He says he can make the very best kind of condensed milk out of silage if it is fed to the cows as it ought to be fed, and the silage is put in as it ought to be. He says the trouble is that there are not half the farmers who put up their silage so it is good. You see the whole responsibility rests right in your homes. A well-matured corn stalk, with the ear on, put in and cut up, is good enough for any body. We surround the silo with so many words that the farmer loses sight of the principal point and comes home and wonders why the cow is not doing well, and I want to give you one or two points on this. We have been learning a good deal about

silo fermentation. I believe we have come to this point, that we can produce silage almost absolutely odorless. I will take you to our silo to-day, and if I do not tell you, you will not know. When I take you into the silo you will know, and not until then. That is a corn silage that is almost odorless. It is brought about by the most complete developement of the corn plant. I do not care what variety you have, but by drying that plant in the sun and evaporating the surplus moisture before it is put in you can secure a silage of this kind. I am not a scientific man, but I think you will bear me out in this. There is no dangerous fermentation in any silo until that silo is exposed to the air. Theoretically there is no fermentation, practically there will be some if you get your silage up to 130° in the pit; there will be no fermentation until it is exposed in the pit. We have the same class of fermentation in silage that we have in the early stages of skim milk. Skim milk often gives, in the early stages of lactation, better results than sweet milk. If you let that stand beyond 48 hours, then begins another stage of fermentation. In the silo the conditions are substantially the same. No harm is done to the silage by exposure to the air for a short time. But after a brief exposure to the air another class of ferments destructive in their action begins at once to act upon the solids of the corn, producing carbonic acid and water. You are feeding food that is grown on the farm cheaper than anything you can buy, and feed the same amount of food.

In regard to the food effect upon butter; butter is made of several different oils. About 92 per cent of the butter fat is made up of three oils, viz., olein, palmitin, stearin. Olein 42 per cent, palmitin and stearin 50 per cent. Olein melts at 41°, palmitin at 140°, stearin at 150°.

It is necessary in getting a nice butter in these days to get a butter that has spreadability. The balance of the butter fat is composed of volatile oils that I do not believe we need to discuss. Now if we feed food like cotton seed—and I do not think much of it; I will tell you that, and I think less of it

every year. I used to put it in every food I made up. Now I would not put it in in any form. Such foods as the cotton seed and corn meal and timothy hay, and corn stalks, all that class of foods, have a tendency to produce an excess of palmitin and stearin in the butter. In feeding foods like gluten, buckwheat middlings, linseed meal and similar meals you will produce the butter with an excess of olein in it, and by a combination of those foods we can pretty nearly control our butter. There is where the private dairyman has the advantage. He can control everything from the feeding of the cow, the cleanliness surrounding her, to the selling of the product. That man is ahead if he is a big enough man to do all the business. As a business man is where the private dairyman breaks down and where the creamery man steps in and succeeds.

Now just a word with regard to the handling of the milk. May I inquire what is the system followed here for raising cream? Separator, chiefly, in the private dairying?

Mr. Tinkham. I do not think the separator is used to the greatest extent.

Mr. Curtis. It is in this part of the State.

I do not want to say that good butter cannot be made in the old fashioned shelf pan, but trouble is frequently met with in that method. I will give you just two or three hints. By the way, the farmer of Vermont, who is running a private dairy, ought to have a Babcock test. I do not see how you get along without it. It ought to go side by side with the creamery in every system of making butter. I used to think I had been doing very well creaming milk with the gravity system. When I began to put this Babcock test at work it found half a per cent. of butter fat. I presume half the milk in the State, if tested, would show half a per cent. of butter fat, if taken at a time when the cows are not all fresh in milk. But you want to take a sample of it every day. If I were to take a sample of skim milk I would have a little bottle, holding about six ounces, and would put into the samples thus taken a little bichromate of potash. I would take a sample each day for fifteen days, and

then at the end of fifteen days would make a test of that composite setting. You would be surprised if you did not find fully ½ of 1 per cent. butter fat. Butter will assimilate one-seventh of its weight in water, from which you can readily determine your actual loss. You will all wish to see how much is going off in the skim milk every day. We want to know whether we are losing or not in handling our cream or milk. I find a good many men break down in handling cream in deep setting cans, either by putting it in too cool, or in putting it in the cans and not rapidly forcing it down to about 40 degrees. You will find even where it is iced, that still, in the center, it actually has not gone down below perhaps fifty after standing at 50 degrees for a time. If you suddenly reduce the temperature down to 40 you will not get the desired effect. It is from reducing it rapidly from 100 to 40 that we have got the best creaming we can get with that system.

Now about handling cream. It requires as much skill to handle the cream from ten or twenty cows as it does to handle the cream from one hundred or two hundred cows. I do not believe the best results can be obtained by carrying cream longer than two days. We take the skimming of to-night and if it is necessary to hold it, carry that at a temperature of 50 degrees, reducing or raising each creaming to that degree before mixing. I say 50 degrees, because under a temperature of 50 degrees there will develop a low order of bacteria, producing bitter or undesirable flavors. That is a question we will all know more about in a little time. At above 50 degrees the lactic fermentation begins its work, and that is a fermentation that we want to develop and learn how to control. If we place these separate creamings in a cream vat at uneven temperatures, there is not a man yet who can, with a paddle, stir those creams together so as to mix it thoroughly enough. We have two kinds of cream in that can every time. What will we do? We want to carry this cream at 50 degrees, 48 to 52 degrees, until such time as we want to ripen it, always raising or reducing the temperature to 50 before mixing. Regrading the ripen-

ing temperature I do not want to say, because I do not know. I do not believe a fixed temperature can be adopted that will apply to every case, but somewhere from 60 to 70. You want to warm this up, either by putting this cream into a hot water bath, or by some other means whereby you get an even temperature through the entire batch of cream, so that when it is churned you will get uniform results and a uniform flavor. I believe it is a wise thing to cool the cream from the separator. I believe it will pay. I especially believe it will pay in the summer time when the weather is warm, and warm your cream up afterwards. Cool the cream down to say 50 and let it stand, and then ripen it very much as you ripen cream from your other processes.

Now just a word about churning, but not very much about this point. The churning point you will have to determine, I cannot. It will depend upon the breeds of cows, and various other conditions, ranging from 54° to 64°. The butter milk is tested as often as we test the skim milk. If churned at a temperature of about 54 it gives us the best results.

Now in regard to the churning, just one or two points only. After having started the churn and having reached the point where the buttermilk has started or commenced to separate—this is the point to which I wish especially to refer. You do not want to be in a hurry. I believe there is not a place in the whole process of butter-making where we make so many mistakes. After the butter milk comes we are in too much of a hurry, but we should wait and let the buttermilk drain as fully as it will, then put on water at the highest temperature possible and have the little butter granules float. I would wash it at the highest possible temperature, and each time after the butter is washed I would allow it to drain just as thoroughly as I did the first time. It will not be necessary to wash it more than twice. You will get the butter free from these solids of the milk, from which comes detrimental fermentation.

Now we are right on the border lines of the study of fermentation and bacteriology. I believe, farmers, it is but a lit-

tle time in the future before we will come to the pasteurizing of our cream, and the use of the pure culture. I looked up some figures recently that show that in Denmark, where they produce uniformly fancy butter, in 1891 four per cent. only of the butter produced in that country was from cream that was pasteurized. Four years after that time 86 per cent. of the cream was pasteurized. We mean by pasteurization, any form of heating the cream up to about 155 degrees farenheit. Now, why is this? Why has this come about? Because the English market demanded a butter that was uniformly mild in flavor. The Englishman, in most things he consumes, desires a mild flavor. It is not so in America. One of the troubles in producing butter for the British market is that most of the butter at the present time has that high active flavor. The man who buys in the American market wants a flavor sufficiently high, so that when he starts the cover from the package the flavor will throw the cover off. In view of all this, it is going to be desirable for us to use a starter, in the pure form of culture, for the purpose of bringing about every time a uniform flavor, if the American consumer still insists upon this high flavor.

Another point: We have not used it yet in our own creameries, but I think we shall, and that is a method of testing the proper acidity of the cream, or proper fermentation. In some States this has been pretty thoroughly tested, especially in Wisconsin. This is done by using 17.6 centimeters of cream and dissolving 5 Farrington tablets in a little less than 100 cubic centimeters of water. Each cubic centimeter added to the cream in order to neutralize the acid will represent .01 per cent of lactic acid and .55 per cent of lactic acid is recognized as the proper degree for best results. (See Farrington and Woll "Testing milk.")

Without doubt the most serious difficulty that confronts the private dairy butter maker is the marketing of his product. After all has been said, the business end of agriculture to-day seems to be the essential end; for without executive capacity success is rarely assured.

The creameryman must necessarily possess this ability, and easily explains why the private dairy as a rule cannot compete.

The dairy farmers of the east should congratulate themselves on their splendid markets. We have only to satisfy the purchaser with quality and he will respond liberally.

No more profitable disposition of time can be made than spending a few days each year with the merchants who sell our goods, and the consumers who are the final judges, studying their demands.

This was not required years ago before competition was strong, anything in a butter tub or cheese box found a ready buyer, not so to-day.

Let me, in conclusion, again urge upon you as dairymen of a great dairy State the importance of intelligence, and activity in your work, looking out beyond the confines of your farms and your State lines both eastward and westward, never forgetting for a moment that while you rest, many are active and ready to absorb your good markets and your good prices.

Mr. President, I have already spoken beyond the time limit given me, and I thank you very kindly for your attention.

President Smith. The best part of these meetings has always been the discussions that come after the addresses, and doubtless there are in this hall this afternoon a good many who would like to ask questions. The discussion is opened by Alpha Messer.

Mr. Messer. Mr. President, I suppose some of our State people are put upon the programme to break the ice after our distinguished visitors from outside the State have spoken. I have been very much pleased with the remarks of Mr. Cook in regard to dairy matters. I have no address to make to supplement the excellent talk that he has made. I think the time can better be used by questioning Mr. Cook in regard to some of the statements that he has made, that we may learn more of how to become successful dairymen. Now Mr. Cook spoke of the silo. We are very much interested in the silo; very many of the people in Vermont are; and in talking about the matter

of silos he spoke of odorless silage. I have for many years, in my own experience, been trying to get at that very point. I have recognized the fact that the odorless silage was the best silage; the silage that had the least acid in it that was developed, and I want to state that I am glad to see that there has been a transition from the first kind of silage we used, which was a very sour silage made from corn that was not half grown, and corn that grew to be very high, and was planted thick where there was no sunlight that came into it to develop the nutrient elements of plant food in the stalks. I say there has been a transition from this way of raising corn to the corn planted farther apart where the ears will develop on the stalk, and is cut at such time as will give the largest amount of nutriment in the stalks, and then put in the silo. But Mr. Cook speaks of drying the corn as much as possible before putting it in the silo. I would like to ask him by what method he treats the corn and puts it into the silo and thereby gets an odorless silage.

Mr. Cook. By sun-drying.

Mr. Messer. Give us your method, please.

Mr. Cook. I tell you it is pretty hard work. I don't know how to impart by word of mouth just how dry it ought to be, because it was not analyzed.

Question. How did you dry it?

Mr. Cook. It has been my idea for some three or four years that the best results to be obtained, and we had gradually worked that way, were with the dry corn. But in doing so it has been with the fear that we would get the corn too dry and it would spoil. This year circumstances helped the thing along. The weather was very warm and dry and the corn after being cut with a corn harvester, was left out in the field from three to six days, on account of breaking the silage cutter, which necessitated the delay. For the last silo filled the corn was exceedingly dry, and we put a little water on that, about 150 pounds to a ton as we put it in. I am inclined to think now that if we had kept the water off from it would have been

as good as it is now, so far as the fermentation is concerned. Just how far along this drying process should get I do not know. In one barn the boys fed down about three feet. One side was practically a little higher that the other. Part of this corn was put in in the forenoon and part in the afternoon. The part that was put in in the forenoon had a little dew on it, and the last, or that put in in the afternoon, was dryer. I going down through this silo I could find the strata where this difference in moisture on account of the dew appeared, that put in in the forenoon having changed faster that that put in in the afternoon.

Mr. Messer. I have found that the dry corn would firefang and I have had to add more moisture.

Mr. Cook. It is a point we must all determine, that in the dry corn we will need to take a good deal more care in packing the corn in the silo than we will in the wet corn.

Question. Have you had any experience in putting in corn whole?

Mr. Cook. Yes sir. I don't like it.

Question. What is the trouble with it; haven't you got courage enough to take it out?

Mr. Cook. Yes, I am pretty well endowed with that. For two reasons. Where the sugar and gums and starches are developed, we lose on that to some extent, as the corn will dry out, the air will not be excluded and the silage will firefang. And then, I never saw any put into a silo whole that would not spoil somewhere. Then there is this difficulty of firefanging. If it is put in too green, you know what the result is then. I have never seen any silo so perfect that it would come out right where it is put in whole. You can not bring about this odorless process by putting it in whole.

Mr. Messer. I have found less odor in whole ensilage. Now in our experience in this State, and there are some who put it in whole and some who cut it, it will give the best ensilage and it will give the sweetest ensilage not to cut it. And if I understand you, your judgment is to cut it?

Mr. Cook. Yes, cut it. In our immediate vicinity there are more silos filled with whole ensilage than with cut ensilage, but they are not as satisfactory.

Secretary Pierce. What variety of corn do you use for the silo?

Mr. Cook. The white glazed corn is grown in our vicinity, and in many instances the hard glazed, or flint corn. Either the white or yellow varieties, because that will get ripe. We want a variety of corn that will mature.

Mr. Messer. At what point do you cut your corn, so far as ripening is concerned?

Mr. Cook. When fifty per cent. of it, if it was cut and shucked and dried, would grow for seed. Now I think that is a very good rule indeed.

Mr. Messer. That will be when the corn is in the first stages of glazing?

Mr. Cook. They have made some very nice experiments at Cornell University. They made one test when the corn first showed the tassel, and the feeding value was found to be $13 an acre. Then they made another analysis when the ear had formed, and the feeding value had doubled. Another analysis was made when the corn was glazed, and considered to be fit for the silo, and the feeding value had raised to $47 an acre. If you let that corn stand until it was hard and dry, it would contain a good deal of the sugars and starches, but it would revert to fiber to that extent that the feeding value would drop back to about $35 an acre. When it is beginning to glaze we get the most milk out of it. Chemistry is good to bank on when the old cow agrees with it.

Question. Do you consider that you get as much feeding value from yellow flint corn per acre when used for ensilage as you do from the larger dent varieties?

Mr. Cook. I hardly know. Of course there is more feeding value in the dent varieties if sufficiently matured, but the point is to get it matured; but in these latitudes let us raise something we can mature.

Mr. Tinkham. What is the value of flint corn as against dent corn raised in this locality? Which would you prefer in this locality, flint corn that you could bring to maturity or dent corn that you could not bring to matnrity?

Mr. Cook. Flint corn every time. Never mind what any body says; grow a corn that will ripen. In this business our trouble comes somewhat from the fact that we think we must do something different. Now when a man builds a silo he should follow the same system of growing the plant that he would if he was going to harvest the corn for the crib, and then that man will have good silage every time. And then, besides, I do not want to handle too much water. I can pump it into a cow cheaper with a windmill.

Mr. Vail. I believe a larger variety of flint corn is being grown here.

Mr. Cook. Yes, that variety of corn is grown all through our section and with good results. I do not think we ought to discuss variety. One man in the same vicinity would grow a large variety of corn and ripen it, and another could not. I know an instance where that has proved true. The one studied the corn crop, and the other did not.

Mr. Vail. I noticed you jumped cotton seed meal, and I hardly knew why. The gluten meals, did you speak of those also?

Mr. Cook. In regard to cotton seed meal; about 70 per cent. of the cotton seed meal produced in the South is used for commercial fertilizer purposes. They sell it to farmers at about 50 per cent. over first cost by putting it in a bag, and they have been obliged to put in a large amount of the hull to keep up with the demand, and the quality is not as good as formerly. The tendency is to feed too much. Two pounds is enough, and men in our State have fed as high as seven and eight pounds. The farmers in our section have had more trouble with diseased teats among their cows when they are feeding cotton seed and gluten than with other feeds. If you are feeding it with good results, keep on; but if you are not having good results it is time to stop.

Mr. Sanford. What are you feeding to take the place of it?

Mr. Cook. Buckwheat middlings. We are buying it now at $7 to $14 a ton, and it has as much value as gluten, and pretty nearly as much as cotton seed meal. Unless you can see and examine what you buy there is always a chance that you get, in the gluten, a grade lower than you buy; and much of it goes into the market in a heated condition, and it has been abandoned by some of the best men in our State.

Question. We are all well aware that the quality of the ensilage depends upon the manner in which it is put into the silo. At what length should you cut the corn in putting it in to get good ensilage, that is, whether you should put it in at a certain length. Some claim that by putting it in short it comes out in better shape.

Mr. Cook. We have cut out ensilage all the way from a half inch to an inch and a half. In a shallow silo by all means cut it short. I used to think they could not produce as good results in a silo 20 feet deep as in one 30 feet deep, but do not believe it now. It will keep just as well if you cut the silage short; about a half inch. I have seen just as fine silage an inch and half long as an inch long. It does not make very much difference, only when it is cut about one inch it may make the mouth sore. If you have a great amount of work, and a large quantity of silage to cut you can take two knives out of the cutter, thereby doubling the capacity, but of course cutting twice the length.

## HOW CAN WE IMPROVE THE FACTORY MILK-TEST SYSTEM.

PROF. J. L. HILLS, Director of Vermont Experiment Station.

Associate dairying has been hampered from the outset by discord and disagreement between those who furnish and those who handle the milk. During the pre-Babcockian era the management generally had the worst of the bargain, being largely at the mercy of ignorant or dishonest patrons. The intelligent and honest makers of the better grades of milk suffered also. The Babcock test, however, has reversed this condition. The boot is on the other leg. Creamery and cheese factory managers can cope with this difficulty, and patrons are apt to think themselves defenseless against possible mismanagement in handling and testing their milk. The air is full of argument, pro and con, touching the accuracy of the Babcock test as a measure of the butter and cheese producing values of milk. The surplus, high test, low test, price for butter fat, for butter, on churn test, etc., etc., are matters of dispute. The correctness of apparatus, the ability, and even the honesty of test operators are called into question. The Babcock test, the best single achievement of American experiment station enterprise, which should be to the dairymen what the compass is to the mariner, is in serious danger of being discredited. This lamentable state of affairs is not the fault of the test, but is largely due to misinformation, misunderstanding and misanthropy on the part of those who do not use the test, and sometimes to mismanagement, misapplication and misstatement on the part of those operating it. Mistakes breed mistrust and mischief. This condition of unrest is more or less prevalent throughout the dairy districts of this continent, and there is crying need of some practical solution of this serious problem. In response to

the urgent request of the officers of this Association I have agreed to give you my views in the matter. My lack of actual practical creamery experience makes me somewhat diffident and fearful of my ability. I do not expect that you will agree with all my propositions, but they may serve to develop a discussion which will prove helpful.

The shortest word in the title of this talk is of vital importance. We! How can *We* improve the factory milk test system? I take that it "we" is an inclusive word. It includes not only the proprietors, but also the patrons. And, moreover, in this dairy state, every good citizen, whether identified with associate dairying or not, should feel a direct, a vital interest in its leading industry. Let us then consider how we can improve the test system under the three headings:

I. What can the management do.
II. What can the patron do.
III. What can the state do.

It seems to me that the management of a creamery or cheese factory may well consider seven different points which should tend toward the improvement of the milk test system. These are:

1. Correct sampling.
2. Correct apparatus.
3. Correct handling of sample and apparatus and of the method.
4. Correct interpretation and application of the results.
5. Gradation of the price paid for milk in accordance with its sweetness.
6. Freedom of inspection by all interested parties of testing operations and records.
7. Promotion of a clear understanding of the system by the patrons, and of mutual good feeling between all concerned.

The patrons may do their share in improving the present situation in at least five different ways. I hope for help here from:

1. Better care of the milk from the time it leaves the udder until it reaches the weigh can.

2. The use of the Babcock test upon the farms in determining the relative dairy abilities of the individual cows, and the variations in milk.

3. The use of the Babcock test upon the farms as a check upon incorrect testing at the factories.

4. An increase of dairy intelligence.

5. More faith and less distrust in fellowman.

The state could materially aid its dairy interests by the enactment of a conservative law regulating certain phases of factory management in connection with the test system. In my judgment such a law should cover the following points:

1. The certification of every piece of Babcock apparatus used for dividend-making.

2. The examination and licensing of every operator of the Babcock test for dividend-making.

3. A uniform standard method of frequent sampling and testing.

4. A uniform method of statement of accounts.

5. The centralization of testing operations.

The audience will observe that I have laid out quite a program for a talk this morning. I will take up these various points one after another and endeavor to give my reasons therefor and to be as concise as possible.

### I. THE DUTIES OF THE MANAGEMENT.

The duties of the management cover:

1. *Correct Sampling*. In my judgment, a very large share of the troubles which have been found in the application of the Babcock test to dividend making is due to imperfection in the methods of taking samples. I am on record in many places upon this point, and can only repeat what I have said for the last two or three years before this Association, that some adequate, accurate, uniform method of sampling is an imperative need. If the sample is faulty, the best of apparatus, handled in the most perfect manner, must give unsatisfactory results. I

know of no method of sampling which insures an absolutely accurate sample under all conditions, and there is no method of sampling with which I am acquainted which cannot through ignorance or design be mis-handled. It seems, therefore, that the best one can do is to advise the selection of that method which is most likely to give correct results. Observation, experiment, reading and consultation with others leads me to recommend some form of automatic sampling device as more surely filling this condition than any other means. This device once established seldom entails upon the busy separator man any more work than does the present system of daily composite sampling. It is not expensive. It is not cumbersome. Its use is readily learned. I think I am safe in saying that once introduced the tendency has been usually towards greater uniformity in the test. And, most important of all, it has been proved beyond cavil that this method properly handled (and its proper handling is easy) will give an accurate sample under almost every condition except that of frozen, loppered or churned milk.

The best form of automatic sampling device with which I am acquainted is that now used by the Franklin County Creamery Association in this city. Its entire separator system of over 70 stations is equipped with it. Many creameries in this and other states have adopted the system. I have yet to hear of a single instance where once adopted it has been abandoned. As used in the local creamery, the device consists of a petcock and a fine wire mesh can cover. The petcock is set horizontally in the base of the weigh can close by the milk gate. The diameter of its orifice is usually about from 1/8 to 1/4 of an inch. The large cone of fine wire-cloth is inverted into the weigh can, and through it every particle of milk is poured. The wire mesh accomplishes three things: (1) it strains out from the milk much material which is not properly a constituent thereof; (2) it serves in some measure to mix the milk, inasmuch as it is all broken up into small streams; (3) it serves to break up all the "flap-jacks" of cream which frequently form on milk which is

one or two days old. When the milk is weighed both milk gate and petcock are opened at the same time, and both are kept open until all the milk has flowed out. Obviously, each horizontal inch of milk must contribute its proportion to a sample thus automatically taken, and even though the milk is not stirred, since all the cream clots are broken, the results are accurate. Their correctness has been shown by hundreds of experiments, some made by experiment stations in this and other states, and some by creameries. I freely admit that accurate samples may be taken in other ways, but I claim that there is less likelihood of error by the use of this method, and that it is greatly to be preferred to the usual insufficient stirring and dipping.

2. *Correct Apparatus.* The management should be able to assert that every piece of apparatus used in its dividend-making is accurate. Presumably the creamery scales and their weights have been tested by the sealer of weights and measures. The accuracy of the quality measure is quite as important as is that of the quantity measure. In the absence of a state law compelling managers of creameries and cheese factories to use certified glassware only, the best that I can advise is that they take advantage of the offer of the experiment station, which has stood for many years, to certify without charge all correct glassware sent them by citizens of the state. The only expense to the management is that of express charges. A great many of the creameries of the state have done this, and the station chemists have smashed many scores of bad bottles and pipettes.

The centrifugal machines are sometimes faulty, either in their original construction or because of wear of some of the parts. The management should be certain that the machine used is capable of doing perfect work, and that it is run at a sufficient speed. The steam jet or cog hand types alone should be used for dividend-making, or, in fact, under any circumstances, as other types of machines are more likely to give incorrect results. Machines should be equipped with speed indicators.

3. *Correct Handling of Sample and Apparatus and of the Method.* The management should be very certain that the person whom it chooses to make the tests is thoroughly acquainted with the method of analysis. Too great stress has been laid in the past upon the simplicity of the Babcock method. Experiment station bulletins, agricultural papers, institute speakers, etc., have enlarged upon the ease of its operation to such an extent that many have been prone to think it child's play, something which anybody, careful or careless, might readily run. Time has proven, however, that this method, while simple, does need a considerable degree of care and attention. My observation has taught me that in many cases it is misrun through inattention to the details, and sometimes because of positive ignorance upon the part of the operator. Care must be exercised from the moment the finished sample is opened for the purpose of analysis until the melted fat is read in the bottle. There are pitfalls all along the line of the analysis in which the careless or ill-informed person may be entrapped. It seems to me that no one thing is of more importance in creamery management than that he who operates this test should know his business.

4. *Correct Interpretation and Correct Application of the Results.* Sampling is now done in all sorts of ways, and samples taken at all sorts of times. In some places a single sample is taken for a month, sometimes a single sample for a week, sometimes a composite sample is built up, sometimes not. I seriously question the usefulness of these single samples, and I doubt their application for the purpose of dividend-making. The composite sample taken daily and analyzed at least three, and, better, four times a month, enables the management more certainly to determine the grades of the various milks. Were I in charge of a creamery I should feel very loth to make a change of, say half a per cent. in the quality of a patron's milk from one test to another, basing this change upon a single sample or a single analysis. The average of three or four analyses is much more likely to be correct than the result of a single analysis, and

there is much less likelihood of wide fluctuations. One can then more surely interpret the analyses and better understand why the changes, if any, occur.

5. *Graduation of the Price Paid for Milk in Accordance with its Sweetness.* I believe that the time is coming when a premium will be paid for the care with which milk is handled by the farmer before it reaches the factory. A milk which is carelessly handled will usually sour more quickly than one which has been well cared for. A fairly good indication of the condition of the milk may be obtained by the use of the alkaline tablets proposed some years ago by Professor Farrington of the Wisconsin Station for the determination of the acidity in cream. The method of using these tablets for determining the acidity of milk is given in the Thirteenth Report of the Wisconsin Station. At their practical creamery they already pay a higher price for a sweet milk than for one less sweet yet testing the same. Some of their fifty patrons bring milk which daily contains not over 0.15 per cent. of acid, the milk of others tests from 0.20 to 0.25 per cent. acid, and some lots contain 0.30 per cent. acid. These tests indicate which patrons are clean with their milk and take good care of it, and which fail to wash their cans clean or have dirty ways of making or caring for the milk. Of course, other conditions, like warm, sultry weather, or infrequent delivery (once in two or three days) likewise affect this test, but after a little practice and some experience it is quite easy to discriminate between cleanly and dirty milk. The rennet test likewise helps here, as does the "nose" test with the warm milk. The acidity test, however, is made with great rapidity. It is stated by Professor Farrington that the man at the weigh can is able to test the acidity of the milk as quickly as he can weigh it. By means of this test, a little moral suasion, and sometimes a good backbone, the management ought to be able to do something toward grading up the character of the material which they handle.

6. *Freedom of Inspection by all Interested Parties of Test Operations and Records.* I am inclined to think that the wider the door is opened for investigation and inspection, the freer and

more above board the entire operation, the greater degree of confidence in results will be found upon the part of factory patrons. If, however, the tests are made privately, if patrons cannot see the working of the test, if they are given no information regarding it, if they are forbidden access to records and books, it is not strange that suspicion is aroused and that recrimination results. I presume that in many cases this suggestion would not prove feasible. It seems to me, however, that it is at least worthy of consideration.

7. *Promotion of a Clear Understanding of the System by the Patrons and of Mutual Good Feeling Between all Concerned.* This seems to me is a step which ought to be productive of much good. I know of some cases where the creamery patrons meet yearly or bi-yearly by invitation of the management for picnics, lectures, social gatherings, or the like. These meetings usually combine sociality with instruction in some of the matters pertaining to dairying. I have attended a few of these meetings and addressed them upon matters connected with the test, and they have seemed to me to be conducive of a decidedly improved feeling between the management and the patrons.

## II. THE DUTIES OF THE PATRONS.

The patrons are not without responsibility, or, indeed, without fault in this matter. Their obligations cover :

1. *Better Care of the Milk from the Time it Leaves the Udder Until it Reaches the Weigh Can.* If the cow is a healthy animal, the milk she gives after the first few streams have been drawn from the teats is largely free from bacteria. The audience will recollect that the souring and putrefaction of milk is caused by the growth therein of these minute plants. They get into the milk from without, seldom from within. The milk sours and spoils more or less rapidly according to the numbers of these germs which enter it from the air, the bedding, the manure, hands of the milker, etc. In proportion as they are prevented from getting into the milk, its keeping qualities are enhanced.

Cleanly methods of caring for the cows and for the milk will tend toward making a better product, which shall command a higher price. I have already stated under the head of the duties of the management that a few western creameries are putting a premium upon care of the milk by paying an advanced price for milk of the same fat content provided it contains less than a certain amount of acid at the time it enters the weigh can. Since the dividends depend upon the price obtained for butter, and since this may be decidedly affected by the cleanliness or dirtiness of the milk delivered, the proper care for herd and milk is a matter of dollars and cents. Unfortunately the present system does not tend to encourage a patron in this matter. A single lot of dirty milk is sufficient to taint the whole batch, to reduce the grade of the butter and to drag prices down. While perhaps discouraging, the more intelligent patrons should set good examples in this respect and thus do home missionary work in the gospel of good dairying.

2. *The Use of the Babcock Test upon the Farm in Determining the Relative Dairy Abilities of the Individual Cows and the Variations of Milk.* In my judgment, the Babcock test is of greater value used upon the farm than when handled at the creamery. It can do more to uplift dairying in the home than at the factory. I do not advise every farmer to own and run a Babcock, but it seems to me that every community that is engaged in dairying ought to possess a machine and that some person should be trained to use it. This person with the machine could then pass from farm to farm, and, in the ways which have been several times pointed out in experiment station publications and on the institute platform, could at a small expense quite accurately determine the dairy abilities of the individual cows. The audience will recollect that several years ago my associate, the present secretary of the board of agriculture, made a census of the state and found that the average cow made yearly 156 pounds of butter, and that the range in the different towns reporting was from 92 to 259 pounds of butter to the cow. Now, while 156 pounds of yearly production is greater than that of any other

state, so far as we are aware, it is not an amount of which we should be particularly proud, nor one which will add very largely to our wealth at present prices for butter. If we were able to add to this figure a statement of the cost of production, it is probable that we should find the profit relatively small. This figure is dragged down and the profits are diminished by the unprofitable animals. In years gone by there has been excuse for the keeping of "cow boarders," because there was no ready means for accurately measuring the butter ability of the cow. This excuse, however, is no longer valid, since, thanks to Dr. Babcock, we have a method which is cheap, simple, rapid and accurate, with which one can rapidly detect the unprofitable cows and weed them out of the dairy. It is probably safe to claim that from a quarter to a third of the cows in this state are an expense to their owners. Would that tuberculosis would attack them.

The variations in milk from day to day, from week to week, from month to month are considerable, and in proportion as the farmer uses the Babcock he would appreciate more thoroughly how fluctuating this material is in quality and might be less ready to look askance at variations in the test at the factory.

3. *The Use of the Babcock Test Upon the Farms as a Check Upon Factory Testing*. I have already referred under the head of the duties of the management to the dangers of inefficiency or worse in factory testing. The patron can entirely obviate this so far as he is concerned by using the Babcock at home. No manager or operator will fail to be careful or to do justice, if possible, if he knows that his results are being thus checked. This seems to me a very feasible method of improving the system on the part of the patron, a very excellent application of the admonition to help one's self. Moreover the use of the method in this way will tend to promote its use as mentioned under the previous heading upon individual cows.

4. *A Growth in Dairy Knowledge*. There is much need of a wider diffusion of dairy intelligence among the makers of milk. Those who are best informed are as a rule less apt to criticise, less likely to distrust. The larger use of the agricultural press and of

station bulletins, the more frequent attendance at farmers' institutes, dairy conferences, and farmers' clubs, the reading of good works on dairying, etc., are all of use. Experience teaches here as elsewhere, yet frequently is misunderstood. A study of the ins and outs of the dairy and creamery business by patrons would be very helpful and would serve to free them from many a mistaken notion.

5. *More Faith and Less Distrust.* Patrons should remember that the object of the testing at the factory is not to add to the profits of the creamery or for its benefit. The creamery would make just as much butter, and perhaps as good butter, if the test system were not in vogue. Of course, the patron pays for the work ultimately, yet the details of its handling at present fall upon the management. As I have already indicated, an increase in the acquaintance with his cows and of the variations in milk will tend to open one's eyes to a considerable extent and make him chary in criticism. I firmly believe that 90 per cent, perhaps 95 per cent, of the troubles are imaginary rather than real. This belief is based upon a large amount of experience, since at the station I have occupied the position of a quasi-counsel in matters of test dispute. *Investigation* and *intelligence* are the watch-words in this connection. I believe that most managements stand ready to meet the patron at least half-way in this matter of investigation, and that in the large majority of the cases the differences which are observed will be found to be due to causes which are easily explainable. In this connection I want to quote directly from an editorial in a recent number of *Hoard's Dairyman*, which contains in small compass so much truth that it seems worthy of record here:

"As a rule the conditions outside of the creamery, with the patrons themselves, have a good deal more to do than they think with the returns the creamery shall make to them. This has been abundantly proved hundreds of times. For instance: In a creamery in this county, a report was made for two years to each patron, of just what his cows earned for the year. To one patron, the highest on the list, was paid $65.65 per cow in a herd of 19

cows, 9 of which were 2-year-old heifers. To the man lowest on the list was paid $35 per cow in an average herd of 20.

What produced this difference in the earnings per cow? It was simply the difference in the patron. One was a dairy student. He read and studied on questions of breeding a good cow, and then, how to feed and care for her. In payment for his exercise of dairy intelligence he received $30 per cow above the cost of keep. The other man did not believe in reading or study on these questions. He knew all about cows any way, and he flaunted the idea of there being any necessity for his studying up on this business. In payment for his lack of exercise of dairy intelligence, he received $5 per cow above what the feed cost him. In the creamery the processes were alike to the two men. The butter from each herd went into a common pool and sold for the same price per pound. But how different the result in the pocket of one over the other. The man who received only $35 per cow was grumbling and complaining all the time, and is the same sort of a man yet. It is simply impossible to make that man see that the fault did not lie with the creamery, but rather with his lack of good dairy sense. He would do nothing to educate himself and results were punishing him for it, but he could not see it.

When there exists a wide disparity in returns between creameries, it is well enough to look into the cause. The fault may lie with the creamery, and no doubt it often does, but a great deal more often it is because one set of patrons are more intelligent, keep better cows, feed and care for them better, and handle their milk in a cleanly, intelligent way, so as to improve rather than destroy the fine flavor that brings the best price.

Until the patrons of creameries learn that there is a big money value to them in striving to make more skillful dairymen of themselves, that there is a big lot to learn in this business of cow keeping, they will be found beating the air wildly for the cause of their poor returns.

The cause in most cases we have found lies right at home in the men who own the cows."

### III. THE DUTIES OF THE STATE.

The state may very properly be called upon to aid in the solution of the problem we have under discussion to-day. I am not a believer in legislation as a cure-all of our ills. It should be invoked only when other means fail. I do believe, however, that there are a few laws which might be placed upon our statute books which, while perhaps class legislation, would be of marked advantage to the farmers of the state, and secure to them a greater measure of justice. One of these laws pertains to the regulation of certain phases of factory management in connection with the test system. No less than three bills were offered in the last legislature touching this matter, all of which failed, as they were perhaps not happily conceived or thought out with sufficient care. The appointment at the last meeting of this Association of a committee on legislation is evidence of the belief by its members that there is some call for action. Laws already exist in the states of Maine and Iowa regarding this matter, and the two first points, which I shall cite as being desirable features of such a law, have already proven very useful in these states. In my judgment it would be advisable to include in any bill upon this subject the following points:

1. *The Certification of Every Piece of Babcock Apparatus Used for Dividend Making.* The Babcock test is not patented. Tom, Dick and Harry make the apparatus. Tom and Dick put out good while Harry makes imperfect machinery and glassware. In the early days of the test there were a good many Harrys. There are fewer now fortunately, yet there are still some imperfect glassware and faulty centrifugal machines sold and in use. As I have already intimated, it seems to me at least as important that this apparatus should be correct as that a yard stick should be just 36 inches long, or that a pound should contain exactly 16 ounces. Babcock glassware should be tested officially as are other measures. Testing glassware is not a costly operation; testing centrifugals would be less easy. The total bill should be small and might properly be an expense to

the factories, glassware and apparatus being shipped to some central point by express for testing. I have seen Babcock bottles so incorrect as to make a difference of fully one per cent of fat in a 6 per cent milk. Such bottles, however, are rare; but those making a difference of 0.20 or even 0.30 of a per cent are not uncommon. It has been claimed that glassware has been made designedly incorrect. I have no knowledge whether any of this is in use in this state or not. I have already stated my belief that the class of centrifugal machines used should be limited to the steam jet and cog hand types. The law should require that each centrifugal have attached to it a speed indicator, and that the proper minimum speed of the machine should be stamped upon it.

2. *The Examination and Licensing of Every Operator of the Babcock Test for Dividend Making.* I have already said under the head of the duties of the management of creameries all that seems necessary regarding the need of thorough intelligence on the part of the operator of the Babcock test for dividend making. I believe this ought not to be left to the will of the management, but should be required by state law. It is impossible to legislate men intelligent or honest, but legislation may serve to keep ill-informed men out of responsible places. We already require before a man can practice medicine, or law, or dentistry, or pharmacy, that he shall be possessed of at least a certain amount of knowlege as shown on examination, usually under state authority. Such persons, passing the examinations, are licensed in one way or another. Steam engineers are required to be licensed, as are probably several other classes of experts which do not now occur to me. I firmly believe that men occupying so responsible positions as do those who determine the quality of milk for dividend making should be licensed, and that the license should be granted only after ability to properly handle the test is shown. This provision would not in the least prevent dishonesty, but, in my judgment, would go far to obviate what I firmly believe is the more common fault of inefficiency.

3. *A Uniform Standard Method of Frequent Sampling and Testing.* At the outset of my talk I stated that imperfect sampling was a very weak spot in the system, and that all sorts and conditions of samples and sampling methods were in vogue. It seems the part of wisdom to adopt a uniform method in this respect as tending to lessen differences, obviate trouble and insure a greater degree of justice.

4. *A Uniform Standard Method of Statement of Accounts.* The Vermont statutes say that the "basis for payment for milk at creameries shall be 4 per cent fat." This law must be a joke, since "brevity is the soul of wit." This is all there is to the law and nobody pays any attention to it. If not a joke its non-enforcement makes it farcial. The intent of the law is to furnish some ready means of comparing the monthly creamery statements of different creameries. Owing to varying methods of statement it is often difficult to say whether creamery A or creamery B is paying the most for milk of a given quality. An authoritative definition of, followed by the enforcement of the existing law is needed. I am not certain but that the methods of bookkeeping should be open to scrutiny inasmuch as some rather questionable methods are in vogue in some places.

5. *The Centralization of Testing Operations.* The first three items mentioned under the head of the duty of the state in the premises, namely, the certification of apparatus, the licensing of operators and the unifying of sampling and test methods are so clearly of advantage that there is not much room for valid argument against them. The wisdom of the idea that I am now about to advance, however, is not as clear. I am not settled in my own mind as to its being either practicable or advisable. I am not wedded to it. It simply represents my present feeling upon this matter, and I may change my mind before I go out of this hall to-day, as discussion may develop new ideas. I offer it simply for what it is worth. One of the great causes for dissatisfaction appears to be that rival creameries, competing for the same trade, cut or swell the test unduly, that the same sample of milk in different creameries appears to test differently.

This claim has been freely made, probably to many in this audience. It seems to me that inasmuch as this matter of testing is in some degree expert work, it were better to have one man testing all the time than twenty men testing occasionally, and that testing for dividend-making might be centralized to great advantage. The state might be divided into sections and a test operator appointed for each section whose duty it should be to conduct all dividend making Babcock tests in his section. His salary and expenses should be charged to the various creamery managements in proportion to the amount of work done for each. These operators should not be responsible to the creamery managements, nor should their continuance in office be at the pleasure of these managements. They should feel themselves responsible only to some central authority, and on that account would be more likely to conduct their operations without fear or favor than is now the case when they are at the mercy of the creamery management for the continuance of their positions. If some such system as this were adopted, instead of Smith, Jones and Brown, neighboring and competing creamery proprietors, each running his own test, and manipulating it perhaps to serve his own ends, or employing a more or less well informed and competent man to run it for him, the tests for all three creameries would be made by one expert, should be comparable, and are more likly to be correct. Inasmuch as the adoption of this system would not obviate errors of omission or commission in the sampling, there would need be one or more experienced test operators who should be empowered to enter any factory at any time, and to take charge of the sampling and testing operations with a view of comparing results thus obtained with those arrived at in the regular course of the work.

Obviously, the scheme I have outlined is sufficiently elaborate to necessitate some central authority. Whether this should be a dairy commissioner or otherwise I do not feel competent to say. I think some such scheme could be put into operation without much expense to the state treasury. The

certification of apparatus should be charged to the managements, the examination and licensing of operators, to those examined. The unifying of sampling and testing methods would cause a slight initial expense. The cost of centralized testing should be charged properly to the management of the creameries in proportion to the work done for each. The test operators with roving commissions could not be paid thus, and probably some provision for their payment from state funds would be necessary. The central authority would probably cost the state more or less. It might not be amiss just here to call attention to the fact that for several years the state board of agriculture has failed to use all its appropriation, and that has covered something over a thousand dollars each year back into the state treasury. In my judgment this amount would go a long way toward carrying out the provisions of a law such as I have outlined. One of the three bills which were introduced into the legislature of 1896 placed the duties of dairy commissioners upon the board of agriculture without increase of appropriation.

I am not in position to say whether a bill such as I have outlined would be constitutional or not. It would probably be somewhat difficult to put into execution if passed, and there would be more or less friction for the first year or two. It would fail to give universal satisfaction. There would still be chances for errors through ignorance or viciousness. I believe, however, that in some such way the factory milk test system in this state might be decidedly improved by legislation.

Let me in closing revert to one of my opening remarks regarding the stress which should be laid upon the little word "we." I would urge that management and patron both put their shoulders to the wheel, that they do not wait for legislation, which may be faulty, but each do his best to try and make their business relations more pleasant. In particular on the management I would urge offering ample opportunities to the patrons for investigation of apparent discrepancies; of the patrons I would ask that they be less suspicious and inform

themselves more thoroughly upon the variations naturally existing in herd milk. I am not looking for the millenium with the opening of the new century, but I believe it is possible to better materially the present unfortunate situation before the 1900's come in. Legislation may be of help, but I hope that a much greater factor in this desirable change will be a greater diffusion of and apprehension of dairy intelligence.

Question—I would like to ask Mr. Hills in regard to the effect of the strength of the acid upon the test. It is sometimes stated that the test of milk may be varied by the use of over-strong or of too weak acid, or by the use of incorrect quantities.

Answer—Too strong acid chars some of the fat, makes an incorrect reading and a fat column which it is difficult to measure. Too weak an acid fails to dissolve all the casein or curd. This rises with the fat in the bottom part of the column as a grayish cloud and obscures the reading. If too much or too little acid of the proper strength be used results are in the same direction as if over-strong or too weak acid were used.

Question—Would the proposed licensing of test operators interfere with testing operations by farmers upon their own premises?

Answer—Not in the least. It would be absurd to raise any barrier, legislative or otherwise, in the way of the farmers' use of this very valuable adjunct to dairying. It is simply proposed to license those test operators upon whose work the dividends of creameries and cheese factories are based.

Question—Are milk samples hurt by freezing after they are placed within the jar?

Answer—I see no reason why they should be injured, provided the jar is not burst by the expanding power of the ice. They would need to be melted by immersion in hot water and then proceeded with as usual. If, however, the milk delivery is frozen in transit to the creamery its proper sampling is a difficult if not an impossible operation. I know of no means

whereby accurate samples of frozen milk may be taken while any of the ice remains.

Question—Much seems to depend upon the manner in which patrons care for their milk. I would like to ask, therefor, whether aerating does not improve the keeping qualities of the milk?

Answer—If the aeration is done out of doors or where there is plenty of good, pure, cool air, the keeping qualities of the milk are enhanced. If the aeration is conducted with impure or warm air and the milk is not materially cooled there will be little if any improvement in this respect. Permit me to quote from the sixth report of the Vermont Station: "If we take into consideration what happens when milk sours, it will help us to see what should be expected to happen from the aeration of milk. The souring of milk is caused by the growth in the milk of countless numbers of bacteria that produce lactic acid. The only way to prevent the milk from becoming sour is not to allow bacteria to enter it, or, if they have once found a home in the milk, to subject it to such conditions as to kill them. Anything which retards the rapidity of their growth will postpone the time when the milk will become sour. Under ordinary treatment it is impossible to prevent these bacteria, these lactic acid germs, from entering the milk. After they are once there the only ways to kill them are by chemicals or by heat. Subjecting the milk to cold retards the growth of these germs, but does not kill them; hence, if milk is kept cold enough it will be a long time before it sours, but at anything less than temperatures near to freezing the growth of the germs will slowly progress and the milk gradually spoil.

Aeration is merely the mixing of the milk with air. There is nothing in this process that should have any effect to check the growth of the bacteria, and since the extra manipulation and exposure makes an increased chance for more germs to enter the milk, it follows from these facts that aeration should have but little effect on the keeping qualities of the milk, and the effect, if any, would be to make it sour more quickly.

Aeration made *without cooling* has almost no effect on the keeping qualities of the milk, but in the use of aerations that both aerated and *cooled* the milk, a retarding of the time of souring follows, which retardation is evidently the result not of the aeration but of the cooling."

Question—If the sulphuric acid used is too weak or too strong, or if too much or too little is used, may one detect these facts by any changes in the looks or the reading of the test? Would not some of the fat be consumed and nothing whatever shown to indicate it?

Answer—The first portion of this question has already been answered at the opening of this discussion. Regarding the latter part, I would say that sulphuric acid cannot eat up or dissolve fat without showing burned fat in the column either as a black, curd-like mass or by the browning of the column.

Question—What is the best preservative for milk samples?

Answer—A liquid known as formalin or formaldehyde. This liquid is non-poisonous, cheap and more effective than any other preservative in use. It may be bought of any of the wholesale druggists at from 50 to 70 cents a pound. A pound is sufficient for five hundred samples for a week in warm weather. One cubic centimeter is enough for a sample. The mechanical condition of the milk thus preserved is better than is the case with any other preservative known to me. It is kept much more fluid, the cream mixes back into the milk more readily, and there has never been in our experience (covering now more than two years) a particle of black curd in the tests, a trouble which we frequently had to combat in using either corrosive sublimate or bichromate of potash. The only objection which can be urged against formalin is the purely theoretical one that it dilutes the sample. The amount used, however, is so small that the dilution cannot be measured by the Babcock test. In ordering, use both terms, as some druggists call it one thing and some the other.

Question—What is it which causes the fat columns of two samples of milk to have different hues when the same amount

of acid is used in each case? One may be a very light yellow, the other a dark yellow or even brown.

Answer—This may be due to slight variations in the quality of the milk, particularly in the amount of solids not fat, it contains; or to variations in the method of pouring in the acid; or to differences in the temperatures of the milks or the acid. Unless the column is distinctly brown one need not fear that these variations in their colors will materially alter the test. If one is interested in this matter he can get the best information by looking up the subject in Farrington and Woll's very excellent hand-book upon "Testing Milk and its Products." Indeed I may be permitted to call the attention of dairymen in general to this book as the best treatise upon the subject in the English language. Anyone who wishes to thoroughly post himself upon the subject of milk testing cannot do better than to obtain this work.

Mr. Currier—A neighbor of mine makes about 400 pounds of milk per day. His last factory test made upon a composite sample about ten days ago showed 4.40 per cent fat. He asked for the sample, carried it home, mixed it thoroughly by turning it from one bottle to another several times and divided it into thirds. He retained one-third, but sent the other two-thirds in three packages to three different points asking for the analysis. The results were 4.55, 4.70 odd and 4.95, all being higher than the original test, which was 4.40. Do you blame this man for feeling that there is something wrong about the testing system?

Answer—I cannot blame this party for questioning these results. The 4.55 test agrees fairly well with the 4.40 result. He cannot look askance at these so far as the agreement is concerned. It will sometimes—yet very seldom—happen that as wide variations as 0.20 of a per cent may occur in two pipettings with the same sample by the same person. The 4.70 odd and 4.90 are widely different from the other two. Assuming that the sampling was properly conducted, there can be hardly any other explanation of the discrepancy except in mishandling of

the test. It is just this condition of affairs which needs in some way to be regulated.

Question—Might not these variations have been due to improper mixing of the sample rather than to improper testing?

Answer—This might have been the fact. Many are uninformed regarding the necessity of extreme care in the mixing of samples. Indeed, the matter of sampling, both of the original material out of the weigh-can and of sub-samples in the jars is altogether too poorly understood by the operators of the test either upon the farm or at the factory. I take an entire hour at the dairy school lecturing upon methods of sampling, and we use every endeavor to instruct our students in the proper methods. In the case Mr. Currier cites, due care seems to have been taken; yet I have known men who claimed to take similar care and, because of their being ill-informed regarding certain precautions, obtained two sub-samples from the same sample which were quite different in their quality. We cannot, therefore, absolutely and dogmatically say in this case that the testing must have been at fault, and you will notice that in my answer to Mr. Currier I have said "assuming that the sampling was properly conducted," etc.

Mr. Sanford—This discussion is nothing new. This feeling of unrest and dissatisfaction pervades the whole state. The year before us is the legislative year. Believing that some action is advisable I move that the legislative committee which was appointed at the last annual meeting be continued another year.

This motion was seconded by Mr. Vail, who then said: I would like to inquire at the same time the nature of the instructions that went with the appointment of that committee. It seems to me they should have power to act. I do not know whether their present instructions would include that, and if not I would enlarge their authority.

The instructions given to the legislative committee at the time of their appointment were read by Secretary Pierce.

Prof. Hills—I was on that committee. Its only power was to report to this meeting of the Association. It had no power to act.

Mr. Sanford—I will now offer an amendment: That the committee have authority to go before the legislature and urge in the name of the Association such legislation as in their judgment the circumstances require. I will further say that that committee consisted of Hon. V. I. Spear, Hon. William Chapin, and Prof. J. L. Hills.

Mr. Towne—It seems to me that it will be well to appoint more committees and to formulate some methods, means or plans to obtain legislation which would be of benefit to the farmers. The creamery men will probably take care of themselves. I would like to ask further regarding the advisability of the plan for centralized testing of milk, and whether accurate tests can be made of samples of milk or cream which are partially churned.

Answer—The practicability of the centralized testing scheme is unknown. If put into operation it might or it might not not prove successful. The scheme which I have outlined in my remarks is not one to which I am wedded, but is simply suggestive. I think, however, that in some such way some improvement might be made upon the present unfortunate situation. It would be utterly out of the question to have all the samples of the state tested at any one central point.

Regarding churned samples I would say that these may be accurately tested by handling them in either one of the two following fashions: Add a few drops of ether and then pour backwards and forwards a sufficient number of times, until the separated fat which will be dissolved by the ether is mixed back into the milk. If any material quantity of the ether is used a correction will need to be made for the dilution. The second method consists of warming the milk up to such a point as will melt the churned particles. The milk is then poured backwards and forwards several times and pipetted with rapidity while the motion is still being continued, in order to pre-

vent so far as possible the very rapid separation of the molten fat. In this way fairly accurate results may be obtained.

A Member—There seems to be a general opinion that some thing to obviate this state of affairs should be done. Would it not be better to pay upon the basis of the pound of butter made rather than upon the basis of the butter fat? I believe that the farmers are many times deceived. Inasmuch as it often occurs that farmers can make more butter from the same amount of milk than does the creamery, it seems to me that it would be better for the farmer if the creameries were compared in this way and if they paid for the butter made instead of on the basis of the butter fat.

The president put the question then before the Association, as amended, and the same was carried by a unanimous vote.

Prof. Hills—I would like to say one word in my own behalf, and I think I speak for my associates. We invite the co-operation of the farmers throughout the state in this work. We shall have much to do during the present year in this matter. There are many and varied views. Anything you can do toward helping us will be very gratefully received and carefully considered.

# CHEESE MAKING.

BY H. E. COOK, DENMARK, N. Y.

There are a good many things we have done not as we ought to have done, in the production of our cheese. I am proud to say now, that New York State is doing grand work in our cheese business. I believe any one adopting the methods employed in the State of New York will make no mistake, at least I believe he can wisely take up those methods. The State has expended some little time and money in instruction in cheese making, and we are producing to-day a much finer product than we were four, five or six years ago. We are better able to meet the wants of the consumer. If I was living in Vermont I would make cheese during the summer months. You have the best cheese market within twenty-four hours of here that there is on the face of the globe. Our cheese is bought all over this country, from Maine to Illinois, and I know of no market that will pay for what they want in a cheese box as will New England. But some of the cheese I have seen made in Vermont is not first class cheese. I do not know but you make it, but the cheeses I have seen in this State are of an open make. They are cheeses in which the fat and the casein may be well incorporated, but the moisture has not been well assimilated, and if this cheese is not consumed in six or eight weeks it becomes sharp, and the consumer does not like it. What the New England market demands is a soft cheese, but a good texture. While in New York State we are making a firm cheese, you people here are making a soft cheese. We have a cheese with better flavor but not as soft. You come to put that rich, fine texture into the soft condition you have and we have a fine flavored cheese that is soft. That is what we have been working for in

our Crown Brand cheese for eighteen years, to produce a fine flavored cheese that at the same time is just as soft as butter and that you can put on your bread and at a temperature of 75 will spread. This kind of cheese can be made in Vermont and sold within three hundred miles of where it is made, at more net money per pound than your butter. I believe I am safe in making that statement. In our factories this year we have been getting from 17 to 25 cents net per pound for butter fat. How does that compare with your work here? I think it is pretty good. That has been made into just this kind of cheese, and not using milk that runs high in butter fat, only about 3½ to 4⅛. Do not think poor milk will make as much cheese as that rich in butter fat, because it will not.

I have a chart here that I want you to see. There is a table that it would do well for any man selling milk for profit to follow. It is figured on the basis of twenty cents per pound of butter. The range of product covers all the different per cents of fat found in commercial milk. Three per cent milk, value of one hundred pounds, 69 cents. The value of a quart, 1½ cents. The value of cheese to match that would have to be 8 2-10 cents. That is, three per cent milk will make a very little more cheese to a pound fat than the other grade. I think your law calls for a 3½ per cent butter fat, which is higher than our law. With those two grades, 3½ and 4 per cent of milk the value of a pound of cheese remains just the same, because the cheese making power of that milk is determined by its fat, as well as its butter making power. With this milk up here (referring to chart) you will observe that we get a little less price for the cheese as compared with this here, (indicating on chart,) although it will bring the same results, because with three per cent fat you get just as much for your cheese product. It will make a little more cheese, but not quite as good. The amount of casein is a little higher. When you get a fat of three per cent the casein will follow up to four per cent, but when we come to a five per cent milk, we have a milk that will not make so much cheese. The casein will not follow the fat,

but you may have a richer cheese. Provided you could incorporate all the fat contained in five per cent milk, or as closely as it is possible to do in 3½ or 4 per cent, you would need to get for the same cheese made from that five per cent milk almost nine cents per pound in order to compete with the twenty cent butter. Here is a little table which is helpful in this connection

| Per Cent. Butter Fat. | Price of Butter. | Price Per 100 ℔ Milk. | Price Per Quart. | Price of Cheese. |
|---|---|---|---|---|
| 3 | .20 | .69 | 1½ | .082 |
| 3.5 | .20 | .80 | 1¾ | .085 |
| 4 | .20 | .92 | 2 | .085 |
| 4.5 | .20 | 1.03 | 2¼ | .086 |
| 5 | .20 | 1.15 | 2½ | .088 |

The point I want to make is that you need not fear but what if you are producing five pounds of butter out of one hundred pounds of milk that you will have the same corresponding value in the cheese production that you will in the butter production. We did not use to think so. We used to think the Holstein cow was the cheese-maker; that one pound of milk was worth just as much as another, but we have learned that the butter fat of that milk is the cheese making power of that milk. Now that we understand this, it will be in accord with the cheese industry in just the same scale to perfect the price that it will in the butter. Now we want, for the cheese purposes, a little different character. We want a milk, first of all, that has been aerated. I do not know that any chemist has given an explanation of this process, but it is by the simple process of bringing the milk in contact with the air. The expert can tell by the cheese whether the milk has been properly aerated or not. In milk, whether used for cheese or butter, there comes, shortly after the milk is milked from the cow, a development of fermentation in it. Now what we want is to be able to control these conditions. We want, particularly for cheese-making, an absence of gasey, and a development of lactic acid

fermentation. You cannot make good cheese without it. In order to bring about this result nine out of ten of the cheese makers in New York are ripening their milk, determining its proper condition with some kind of rennet test; and we want to avoid these inferior, detrimental fermentations that produce gas. You have all seen cheese as round on top as it was on the sides. You cannot sell that kind of cheese to-day, where the gas has fermented the cheese. We want to kill all this right in the start in the milk. That is brought about by adding a starter, just as you do in your cream. Now here is another point; in the supplying of the New England trade particularly. They want a small cheese. We make them all the way from five pounds to thirty. We have customers who want five pound cheese, and if they wanted a one pound cheese I don't know but we should make that. Sage cheese, colored cheese, white cheese, whatever the variety, the market wants. The domestic market will take cheese weiging from thirty to fifty pounds, and still the smaller or twenty-pound cheeses are sent for more than the larger cheeses. The Englishman is calling for a cheese that weighs ninety pounds. They want cheese a foot high. They lay them down and cut them in two, and turn them over and really get what is known here as a flat or twin cheese. The Englishmen eat cheese at the rate of from fifteen to eighteen pounds per capita, while the American people only consume two to two and one-half pounds. If we could eat just one pound more per capita in this country we would not have one single pound of cheese to sell to John Bull, and I don't know why we don't do it, unless it is because we have palmed off so much of this skimmed cheese and filled cheese onto the American customer that he has got so that he does not like it. At this meeting how many do you think there are who like cheese. There are some four hundred people here; will these who like cheese please raise their hands? Four men and one woman. Well, if we would produce as good a cheese product as the miller does a flour product we would have to increase the manufacture of the cheese product in the next year. I do not know

of any better way to create an appetite in this country for American cheese than to produce the kind of cheese the American people want and then they will buy it. Every pound of cheese contains two and one-half times as much nutriment as a pound of beef, and still we buy beef and pay fifteen to eighteen cents a pound for it, while the same money paid for beef buys an article of food which contains two and a half times as much feeding value per pound when used in the purchase of cheese. I do not believe there is a dealer in this town who will not tell you that his cheese is one of the least profitable articles in his entire trade. The average consumer buys a quarter or half a pound and eats another quarter of a pound while he is buying that, and before he comes back to buy any more, you will lose another quarter of a pound by its drying up, and consequently it is not a profitable retail business.

Now I believe that the Vermont State dairyman cannot do anything better than put himself in the front rank as a cheese producing farmer or dairyman, and by producing this kind of cheese that is solid and rich and waxy, and fine flavored, and one that will grow better the longer you keep it; and you know you can make a cheese that is as soft as butter and still have it good, and at the end of the year it will be just as good as it was when first ready to use. I do not see why more people in the State of Vermont are not cheese makers.

Mr. Messer—In some sections of our state there seems to have been a practice of making cheese in the summer and butter in the winter.

Mr. Cook—That is our practice exactly. Although I believe as fine cheese can be made in the winter as at any other season if the conditions are only right; and if you have a market and want to make them in January, then make them. But the conditions must be right. You must have a certain amount of succulent foods. I do not believe you can make a desirable cheese on dry foods alone. Further than that you must be able to control not only the temperature but the moisture as well, having a hydrometer in the room. We carry it a little above the

normal, about 20 per cent. and with a temperature of about 65°, you can then make cheese in the winter as well as in the summer with just as good results.

A Member—I am very glad that I came here this afternoon because I have found out one thing that has puzzled me very much. I could not understand why it is that the grocers are in the habit of charging 16, 17 and 18 cents for cheese when you could go right out in the country and buy it for 7 and 8 cents. I now understand how he can do that. I supposed he was getting a corner on that article, but I am very glad that such is not case. I have heard a great deal said about making higher grades of cheese, and it has often been asked why we could not make that quality of cheese here as well as they make it in Switzerland and England and other countries. I understand that in Connecticut, I believe, they are making what is known as the pineapple cheese, which sells for 25 cents a pound or in that neighborhood; and the question is, why can we not make that class of cheese in Vermont as well as there. There is a demand for it, and if we could make that form of cheese as well as the commoner cheese it seems to me it would be better and more profitable to the cheese makers. I would like to ask Mr. Cook something about that.

Mr. Cook—Do not be misled by thinking those varieties are not being made here now. They are, in immense quantities. For instance, we have the F. X. Baumont & Co. plant, which has produced perhaps the greater portion of the cheese of that kind in this country. They say anybody can make them but anybody cannot sell them. That is so in regard to these fancy brands. All those varieties of cheese are being made in immense quantities, and it is the proper thing to educate the American people to consume them. We are making probably as fine cheese of that stamp here now as in any country, barring the Swiss cheese. They have not succeeded in this country yet in making as fine a Swiss cheese as they make abroad, which is probably due to the proper bacterial growth in the milk. They have some of the

best Swiss cheese makers in this country, but they could not bring the Swiss bacteria with them. The better quality is due to the bacterial growth. Neuchatel are made in perfection.

Question—Do they make Limberger cheese.

Mr. Cook—Yes, in great quantities.

Question—How do they purify the atmosphere?

Mr. Cook—The New York atmosphere will purify itself, (laughter). The Neuchatel and square creams are being eaten by people everywhere and there is a growing demand for them.

President Smith—I am very glad Mr. Barry has found out, and equally sorry for his customers that he has found out, what to do with his cheese.

Mr. Messer—In regard to the other subject Mr. Cook was discussing, he made the statement that every farmer should use the Babcock test. Now we are told by our experiment station workers that it takes an expert to run a Babcock test and do it successfully. I have one of my own, but I am almost afraid to try to use it because I am not perhaps getting accurate results, and am not sure when I read the per cent. of butter fats whether they are right or wrong. Will Mr. Cook tell us how an unsophisticated farmer can use a Babcock test and be sure that he is all right?

Mr. Cook—It requires an expert to do anything successfully. Any one who can make good butter or cheese is skillful enough to handle the Babcock test and get accurate results. Of course it requires care. If you follow the directions and become a student there is no trouble in making a test with the Babcock test. You do not need to entertain any fear about using the Babcock test.

Mr. Messer—I have understood that it was an excellent way to test the milk to put sulphuric acid and water together, and as it was used it was run from the receptacle into the neck of the little bottles.

Mr. Cook—That was not the Babcock test was it?

Mr. Messer—Yes sir, it is some new wrinkle.

Mr. Cook—I would suggest that you mix sulphuric acid and water with a great deal of care. Every man who is interested in the testing of milk should send a dollar to the Wisconsin Station, or if you will come over to the hotel I will give you the name of the publishing house, and get Farrington & Woll's Testing of Milk. It is the most complete and most accurate of anything that has been given to the public.

Question—I will ask Mr. Cook if he thinks every farmer should have a Babcock test?

Mr. Cook—If you are delivering milk to the creamery it is valuable. The old test we used to test with was by a little tube. Some of the milks contain a little more of this fibrin and albuminous portions, which retard the cream in coming to the top, and one cow may give four per cent and another 5 per cent, and still show an equal amount of cream. You want to know how much butter fat you are giving to your pigs. You can find that out by testing your butter milk.

Question—Which is the best way to raise cream, with the separator or with deep-setting?

Mr. Cook—My impression is with the separator, although I am not an agent far any machine.

Question—The globules are not injured in any way by the use of the separator?

Mr. Cook—No sir. Buy the separator that will run thirty-five or forty per cent cream. Then you have a cream that will make better butter, and that same cream will produce butter that will carry a little more moisture than cream that contains only twenty or twenty-five per cent. I mean if you put the cream into the Babcock test it would test thirty-five or forty per cent butter fat. Separators ought to skim down to a tenth of one per cent. When you read of their skimming it down to one hundreth of one per cent, that is on paper. If you have a machine that will skim down to a tenth every day, under all conditions, you are doing good work.

Question—In testing cream for churning, take cream that will test twenty butter fat, what per cent of surplus does that overrun?

Mr. Cook—That depends on how exhaustively you churn. The surplus of butter over butter fat depends upon the amount of moisture on the butter, providing the churning and separating are complete. In our creameries we average about 1.15 lb. butter to 1 lb. butter fat.

Mr. Davis—I have tested and figured it out in one man's cream, and it overran a quarter of a pound on the Babcock test.

Mr. Cook—Do I understand you that for every pound you got a pound and a quarter?

Mr. Davis—The Babcock test stood at twenty pounds and when I churned it I got twenty-four pounds. Some one might say that I had water in my butter but it was very dry.

Question—In Jersey butter will there not be a little more water?

Mr. Cook—In 5 and 6 per cent milk we will ordinarily carry a little more water to each pound of fat than in 3 to 4 per cent milk.

President Smith—Do you stack your corn, and would it pay to do so?

Mr. Cook—That adds to the expense. I am rather inclined to think that it would not. I do not think that you can afford to husk your corn. The point is whether that corn meal is worth any more than the corn is when left in the fodder. It will cost one-fourth the value of the corn to husk it and grind it. I do not believe it is worth a cent more, but that that labor is thrown away.

Mr. Terrill—Didn't this corn grow on too heavy ground? My corn got so dry that it would bake in the mow, and to keep it from hurting I added about three hundred pails of water to it, and it seems to me this must have had more moisture after it was put in.

Mr. Cook—It would dry out more if cut by hand than it would if cut with a harvester. Our soil that we grow corn on is a loam.

Mr. Terrill—My soil is cobbly, and the corn was dry enough to snap from the stalks when I cut the corn.

Mr. Cook—Just remember this, that when a cow passes a kernel of corn whole she will, or might, pass a dozen kernels of corn meal and you will not be apt to see it.

A Member—I have noticed that when feeding meal you will find considerable meal that goes into the manure pile.

Mr. Cook—Probably the cow is over-fed if she does not digest corn meal.

Question—Would you exclude the air, or cover it so as to exclude the air?

Mr. Cook—You can add some six or eight inches of straw on top, but if you have but one silo and commence feeding early it is not necessary to do this.

Mr. Vail—In the early part of this lecture the gentleman dwelt largely upon the constitution of the cow. As an important matter, I would like to have him go a little further on that. I wonder if he has not found in his practice, cows with very fine constitutions, and cows that were well bred, that when they came to the test gave so low a grade of milk, a milk so destitute of butter fat, that no man could afford to keep them?

Mr. Cook—Most certainly. I do not mean that every cow is a good cow, by any means, but so far as the milk producing power of an animal is concerned it is pretty safe to bank upon the peculiar formation. I do not want to say that I can every time pick out the butter fat quality in a cow, but I believe I can tell a 5 per cent animal from a 3 per cent animal by the appearance of the skin.

Question—By the breed, too, can't you?

Mr. Cook—Yes, sir; we should expect richer milk from Jerseys and Guernseys. Four per cent fat is the ideal, and they are getting many Holsteins up to that point.

Question—Can you get that per cent by feeding.

Mr. Cook—I don't know of anybody who has been able to feed a 5 per cent cow out of a 3 per cent one. This question of feeding butter fats into milk is a most important one. From

many tests I have concluded: That any ration which furnishes the cow all the protein and carbohydrates she needs, including succulence, a ration upon which she will produce a normal flow of milk at the same time retaining her normal condition and health, will produce a maximum per cent of butter fat in her milk. When a highly nitrogenous ration is fed we may for a time so stimulate the animal that she will increase her butter fat, but it will only be temporary.

A Member—I know one man who used to say you could not feed a 5 per cent cow out of 3 per cent, but that you could feed a 3 per per cent cow out of a 5 per cent.

Mr. Cook—I know of but one thing that will do it, and that is by feeding this miserable silage spoken of here.

# THE EVOLUTION OF A RATIONAL SYSTEM OF CATTLE FEEDING.

BY PROF. W. H. JORDAN, Director of New York Agricultural Experiment Station.

The problems pertaining to the feeding of farm animals are complex and difficult. There are two reasons why this is so:

(1) Numerous facts are related to these problems.

(2) Our present knowledge of the physiological and chemical questions involved is very imperfect.

The facts are those revealed by both scientific research and by practice. Our knowledge which, when established, is scientific no matter what its source, is the result of accurate observations, in the laboratory and in the stable. Science has repeatedly explained what practice has discovered, and in doing so has often been wrongly credited with being the only source of information.

These explanations are, nevertheless, essential to progress; they are the beginnings of correct reasoning, the fundamentals of correct practice.

I shall, therefore, boldly assert before you to-day that the chemical investigations of the last fifty years have been necessary to the establishment of an intelligent system of feeding farm animals, a system more rational to-day, I believe, than ever before, even under conditions growing more and more complex. Some farmers agree to this statement, others do not. There are those who, although they are unconsciously using the phraseology which science has taught them, and are imitators of the practices which their neighbors have learned from Experiment Station bulletins, declare that they are sufficient unto themselves and boast of the superior wisdom coming from experience.

How long shall we continue to apply the term *experience* to loose, incomplete, unrecorded observations and quite contemptuously characterize the accurate and exhaustive records of some experiment station investigations as mere theory. What is experience? Is it not the trial of some method, the actual acquaintance with some fact?

How shall we try a method unless we test it severely on every side and how shall we more surely become acquainted with a fact than by using the most searching means of observation?

Occasionally a man of science, when he allows his thought to dwell upon our ignorance rather than upon our knowledge, becomes skeptical as to any real advantage which the feeder has gained from the investigations of the chemist.

I have a friend, whose name is familiar to you all, who, when he wishes to excite me to controversy, declares that so far the chemist has not really aided the farmer in the use of cattle foods. This good natured pessimist is fond of asserting that chemistry is not competent to determine whether any given substance may be used as a food, but that the final decision must be made by the animal; and then having delivered this fallacious argument he takes great enjoyment in my frantic efforts to annihilate his most discouraging position. The discussion usually ends with a mutual conclusion that the discovery of truth is a slow and trying process, and that many of us "know a great deal that isn't so."

It is my purpose at this time to discuss briefly, not what we have learned concerning the minute details of rations and feeding methods, but what science and practice have given us as the fundamentals of a creed to which we can wisely subscribe as breeders and dairymen. Here is the farmer of to-day with his farm on the one hand and his herd on the other, the former supplying and the latter utilizing energy and matter.

The great questions are, then, how shall he, as a dairyman, economically secure and use this energy and matter?

What can the farm do for him and to what extent may he wisely resort to the markets? What is *rational* in the light of existing knowledge?

The low prices for dairy products which now rule, give to these questions a degree of importance which is commensurate with the difficulties of realizing even a small margin of profit.

This subject has, therefore, two divisions, viz.: (1) The home production of cattle foods and (2) the purchase of cattle foods.

The two questions we shall ask, and from which we shall proceed as centers of discussion, are:

What has experience, scientific or otherwise, taught us concerning the function of the farm in feeding animals and what is the function of the market as a supplement of home production? Unquestionably the financial success of dairying depends largely upon a proper adjustment of these two functions. While this adjustment must vary with varying conditions and cannot be controlled by inflexible rules, it is true, nevertheless, that during these later years, when it has been so easy to fill the grain bin from the western farmer's surplus, and in which the shrewd seller of all sorts of waste products has been active in every part of our state, the farm function has almost been eclipsed by the market function. A reaction from this state of things has already set in, and it is one purpose of this paper to aid in accelerating this movement.

A knowledge of certain facts is essential to this discussion. If the feeding of a dairy cow was brought to our attention for the first time, if the foods and the animal were not now understood to some extent, we would at once inquire, I am sure, what foods are and how the animal uses them.

It is by giving us this necessary information that science has really helped the dairyman to a rational philosophy which he may apply to the production of milk.

It is not enough to say that we store in barns hay, silage and oats, or that we can go into the market and buy bran, gluten meal and the oil meals. All these materials whether home grown or commercial, have in common certain compounds, and a certain energy, which are the fundamental considerations. Primarily the farmer garners for use, not timothy, not clover,

but forms of matter and energy which are the common attributes of all vegetable tissue. This energy is applied to the warming and operation of his milk machines and this matter is in part used as raw material for building heifer calves into cows and for the manufacture of milk solids.

These compounds common to feeding stuffs are familiar to you. You call them by name (not the chemist's name perhaps) when you buy them at the store, your good wife uses them in her household operations and three times a day she places them upon the table in easily recognizable and appetizing forms, perhaps for the delectation of a good-natured, hungry man and perhaps as objects to be grumbled at by an over-critical, fault-finding husband.

When you were a boy, and perhaps since, you put a handful of wheat into your mouth and masticated it until there separated from it a mass stringy and tough which you called wheat gum, and which we now call gluten. This morning you ate a boiled egg and perhaps a piece of juicy steak or a slice of cold chicken's breast. Probably you sometimes indulge in a delicacy made from the much despised skimmed milk which the Celtic tongue has taught us to call bonnyclabber. All these are object lessons of that class of compounds we call protein, and which, containing nitrogen as they do, have a function of supreme importance in building the working tissues of your herd of cows and in producing certain milk solids. They are important too, because their nitrogen is commercially costly, and when once possessed is retained for plant-food purposes only by great care. Highly important is it for you to know that as a rule your farm crops contain little of this protein, and some of the commercial feeding stuffs, a great deal. This fact we shall discuss later.

Just now New York is convulsed from one end to the other over a proposed new industry, viz., sugar beet culture. It is believed by many that this nation should produce the beet sugar which costs us annually eighty or ninety millions of dollars. It is the sugar we are after, because it stands very close to our

every day needs and luxuries. Away up in the most northerly county of our most northerly state where potatoes grow as they grow in few places, potato starch factories are numerous and the cotton cloth maker in the sizing which he uses, and the judge in the added dignity which his immaculate shirt bosom lends to him, are benefited thereby. Corn starch pudding and tapioca puddings are in your bill of fare. Your pumpkin pies are always at their best when they are sweetened with molasses. If you have clerical duties the pot of mucilage made from a gum is an essential part of your desk equipment.

These sugars, starches and gums all belong to another class of compounds which in the domain of animal nutrition are in the rank of first importance as to quantity, and as to function they are no less essential than any compounds. We call these carbohydrates.

Your hay mow, your silo and your grain bins are full of them. They are the fuel which feeds the furnaces of animal life and from their transmutation into simpler forms largely proceeds the energy which supports the complex activities of the field, the dairy and the home. If you fatten your beef animals and your pigs, the carbohydrates are chiefly your source of raw materials. They are burned to give you animal warmth and energy, and whether you want lard or tallow, goose grease or hen's oil, they can be transformed into all these substances.

There is one other much discussed and commercially important class of substances which we must not ignore, the fats or oils. All plants contain these in proportions varying from the 20 or 30 per cent of the oil seeds down to the one per cent of rice, peas, etc. Even the driest straw will yield some oil.

If you wish for examples of vegetable oils, watch your wife make a good salad, using olive oil which is expressed from cotton seed, or the painter mix the paint, a prominent ingredient of which is the oil that the flax plant manufactures.

We are hardly courageous enough to utter a dogmatic statement as to what uses the animal may make of these oils, but we know that they are burned as fuel being especially valuable for

this purpose. One pound of fat will supply 2¼ times as much heat as a pound of starch or protein. When, however, we get outside this single function of these compounds we enter a field of uncertainty.

Excepting the water and mineral matter we have now compassed in a general way the compounds which are universally found in our cattle foods. Let us get nearer to the cow and learn how she disposes of these substances which are fed to her.

If she is a good cow and is treated fairly she eats daily about 24 pounds of dry substance, water-free, the chemist would say, the amount varying somewhat according to the character of the ration, whether containing a very large or a moderate proportion of grain. Part of this dry matter is useless to the animal, perhaps eight pounds, because she is unable to dissolve it and so she casts it aside and it passes out in the draught. The other sixteen pounds are taken into the blood, and constitute the actual food. If the feeder is a disciple of the German standard rations, 2.5 pounds of this digested 16 pounds are protein and the remainder is nearly all carbohydrates. How does the animal dispose of this material? How much is returned to her owner, and how much does she destroy? Not over four pounds or one-quarter of the digestible matter eaten is found in the milk and urine, 3¼ pounds of which would be milk solids. At least 12 pounds of these nutrients disappear in the gases which pass from the lungs and skin, unless the cow is fattening at the same time she is giving milk. An important thing to know is that nearly all of this burned material belongs to the carbohydrate class, certainly 10 pounds of it. The great bulk, then, of the raw materials that you must use in manufacturing dairy products are the sugars, starches and gums which nature produces for you in such great abundance. They are, as a rule, the cheap necessities in animal nutrition.

We will now proceed to a direct consideration of our original questions, the first of which is, What is to-day the function of the farm in feeding dairy cows? The farm is a great carbo-

hydrate factory. Not over 1-8 of the dry substance in your standard crops consists of protein, the other 7/8 being largely carbohydrates.

Your main crops and the ones you can grow most easily, and with little expert care are distinctly carbohydrate crops. They are the traditional crops of the farm, a knowledge of which has descended from father to son—timothy and the natural grasses, corn, barley, oats, wheat, potatoes and roots. It is these crops, the natural grasses including the cereals, with which you have the fewest difficulties of climate and culture.

On the other hand the protein crops are the ones that as a rule either yield small returns, or are rendered uncertain by climate, drought or frost.

For this reason many farmers are slow about giving them a fair trial, and they have clung to the old time standards. There is nothing strange in this. It is strange, though, that with the tremendous possibilities of the fertile lands of New England for hay and corn production, for carbohydrate production, if you please, that we are in the market for western corn to the extent that we are. Vermont farmers are large buyers of the starch which comes to them from the Kansas farmer's surplus. Think of this a moment. Your best fields will produce, if you are as good farmers as you ought to be, a corn crop containing no less than 6,000 pounds of dry matter per acre, at least 4,800 pounds of which is starch and similar compounds. It is a crop easily and cheaply cultivated, will endure everything but bad drainage and frosts and is with you every year. But this objection comes to the front. It is said that we can't raise corn at 30 cents per bushel. Perhaps we can't if we have the wrong notion that the ears represent the whole value of the crop, and believe that the silo is a delusion and a snare. But if we have come to understand that the ear is less than half the value of the whole plant and that the silo offers a safe, cheap and unlimited means of preserving the corn crop for any reasonable length of time, your basis for such an objection is taken away. Can we raise

50 bushels of shelled corn per acre? Then the whole crop is equivalent to 100 bushels.

Perhaps some of us have fallen into the snare of a method of book-keeping that has so often led the farmer to false conclusions. We may have decided that unless the home cost of a farm product, with labor at the usual prices, is less than its market cost, we will purchase rather than grow it. In some instances this may be correct reasoning, but not always. There is a great difference between using the teams, machinery and men which are the necessary equipment of every good farm, to till 10 acres of corn and paying out the $300 which the equivalent of such a crop would cost.

Cash which is paid out must first be earned. With the dairy farmer this expenditure means the selling of many quarts of milk or pounds of cheese. As a matter of good business policy dairy farms should produce a very large part of the carbohydrate food needed.

How shall we do this? Chiefly with corn, combined with such hay and grain as properly come into the rotation. I do not refer to sowed corn, watery, immature and earless, but corn planted with a view to getting the largest possible production of ears. We had at the New York Station this year 12 acres of Improved Leaming corn that was good to look at. Would you like to know what we did with it? We let it stand until the kernels began to harden, and then we put it where the corn crop should go on every dairy farm--into the silo. The ears were large and fine but in they went. Some of that corn we shall not feed out until late next summer or in the early fall of 1898.

Much has been said about the silo, but it has not yet come to occupy the place it should as an adjunct to the dairying of New England. It is a protection in time of drought and one remedy for the purchase of so much grain. Silage improves the ration, constitutes a store of carbohydrate food which may be kept an indefinite time, and properly made and properly fed

has, in my judgment, never yet injured a pound of milk for any purpose whatever.

There have been many attempts of late years to add to the list of home grown fodder plants. Experiment stations have done their share of this work and we hope their officers may be forgiven for ever considering the possibility of grafting upon our agriculture such plants as prickley comfrey and a few others.

Two conditions are essentially involved in the successful introduction of a new fodder plant: 1st, it must be palatable; 2d, it must be fairly productive. Those present who have been familiar with agricultural affairs during the past 20 or 30 years will surely agree to the statement that few new plants have been able to compete in these particuliars with the old standards in New England. Hungarian grass and the millets are useful in a series of soiling crops, and alfalfa is one of our most valuable plants when it can be grown successfully, but outside of these two species we know of no successes.

It is quite the custom for our institute speakers to urge farmers to pay especial attention to such protein plants as their farms will produce, on the ground that they are in the market for protein with which to supplement the home grown supply of cattle foods. Doubtless this advice is sound. It is unquestionably true that every dairy farmer needs a larger proportion of nitrogen compounds for his cows than his fields supply, if he is to feed to the highest point of efficiency. There are those to object to this view. These persons say that nature does her work in the best way and that man can scarcely improve on what she has provided for the brute to eat. But man is a disturbing factor in nature's methods. If the dairy herd could have a perennial supply of June pasture grass, rich in protein as it is, less study of rations would be necessary. It is a well recognized fact that the young plant has a relatively large proportion of nitrogen compounds and that the later growth is almost wholly of carbohydrates. Dried pasture grass has three times the proportion of protein that timothy hay has. Numer-

ous analyses show that as our fodder plants increase in age and maturity, their percentage content of protein decreases. The stored crops are matured crops, containing a minimum amount of protein, consequently we should not be surprised when we are told that the great weight of evidence furnished by experimental study is in favor of more protein than is supplied in the average ration of hay and the cereal grains. It is important, therefore, to look the field over for protein crops that may be grown on the farm. After we have looked we find a very limited list of species. There are the clovers, beans and peas, all of which are valuable.

To be sure clover is a little uncertain, and is a difficult crop to cure in bad weather. It is not adapted to permanent meadows, but finds its best place in a rapid rotation of crops, which is after all the high-typed method of farming. Clover is a crop to be cherished and of which only a small minority make the best use.

The pea plant suffers in our estimation because of its very moderate yield of dry matter. It furnishes food of the very best quality, however, and is indispensable in a continuous series of soiling crops, being usually combined with oats. Alfalfa appears to be one of the newer crops that is destined to find a permanent place in New York agriculture. It is probably not adapted to this state but certainly succeeds well in some parts of the middle states.

Portions of the New York station alfalfa field are five years old and are in fine condition. Our yearly crop is equivalent to 4½ tons of hay per acre and our only expense, except cutting, is the cost of an annual application of fertilizer, amounting to five or six dollars per acre. We use this crop wholly in the green condition. The surplus, when we have any, is cured for hay as easily as is red clover. This year we filled two small silos with alfalfa in order to test its possibilities for winter feeding as silage, and our results will be reported in due time.

We now come to our second question :

What is the proper function of the markets as a supplement to home production?

In view of our previous statements, there is but one answer, viz: a protein function, so far as possible. We have seen that the farm produces carbohydrates early and in great abundance and that the crops of a more distinctively protein character are few in number, the cultivation, as a rule, presenting more difficulties than does that of the grasses and the cereal grains. It seems logical, then, that if we must buy at all, we shall purchase protein.

Just here we arrive at difficulties. The names of commercial foods are legion. Those that carry large percentages of protein are nearly all the waste products from some manufacturing process. We have the oil meals, residues from the extraction of oil from cotton-seed and linseed, gluten feeds and meals or the part of the maize kernel that is left after taking out much of the starch, the wastes of breweries such as malt sprouts and brewers' grains, bran and middlings, the bye-products of our flouring mills, and certain waste products from the manufacture of breakfast food, as for instance oat feed that is the part left after taking out the oat meal, rolled oats, etc., which are prepared for family use.

From this large number of feeds, what shall the farmer select? Several factors must be considered, chiefly composition, cost and effect on the health of the animal and the quality of the product.

If, in our search for nitrogenous foods, we regard these materials from the standpoint of composition, we must throw out of consideration the oat feeds and similar substances, unless they are fortified with gluten or the oil meals as I suspect is sometimes and perhaps always the case. In themselves these residues are scarcely more nitrogenous than the grains from which they come.

I am amazed at the extent to which the American farmer has sold certain cereal grains to the manufacturer of a high class of human grain foods and then has bought back the hulls, the

light grains and the less desirable parts of the kernels at prices nearly equal to those which were originally received for the oats or corn from which the choicer parts have been removed. How long shall the skillful vender of an article which is "new under the sun" hold superior sway over the judgment of human kind? How long shall we buy with hard earned money the very materials which Nature offers as the reward of intelligence and industry?

What then shall we buy? Why those feeds in which have been concentrated the compounds that supplement the convenient and logical supply of the farm, viz.: the nitrogenous feeding stuffs.

The brans and middlings are not highly nitrogenous, except that buckwheat middlings ranks well in this particular. The brewers' grains, the gluten feeds and meals and the oil meals are the materials that carry large proportions of protein.

These classes of materials, especially the oil meals and glutens, have their trade advocates, who claim all kinds of superiority for the special goods they represent.

A bright representative of the linseed meal interests called on me the other day and very modestly claimed that the health of our farm animals depends very largely upon the use of that bye-product. He informed me that he was even feeding it to his son in order to heal him of his diseases. But, seriously, is digestible protein from one of these sources more valuable than from the others? Probably not. Is oil meal protein better than gluten protein or brewers' grains protein? I cannot believe it. Has science or practice ever demonstrated a difference which the dairyman ought to consider? Not to my knowledge. Of course one kind of protein may furnish a larger proportion of digestible material than another, but so far as we have any exact information, the digestible nitrogenous compounds of our seeds and grains are not essentially unlike in their possible function in animal nutrition. In fact you can be referred to many experiments in which the substitution in the ration of one nitrogenous bye-product for another has not affected the quant-

ity or richness of the milk in the least. Such an experiment has recently been conducted at the New York Experiment Station, the results of which will soon be forthcoming.

Now you ask, perhaps the protein of these foods does not vary much in value, but do not the foods as a whole, or in other words, the compounds associated with the protein, have a marked effect upon the quality of our dairy products? None worth mentioning in the case of milk and cheese, I am sure. In the case of butter, the relation of the grain ration to its hardness, color and flavor is shrouded in uncertain knowledge. On this point I get diametrically opposite testimony from dairy farmers and science has not yet given us plain and consistent information. My own opinion is, that almost any grain food which is in a sound condition may find a moderate use in a mixed grain ration without detriment to any form of dairy product. This opinion will doubtless receive criticism which I shall most heartily welcome.

When we discuss commercial cattle foods with reference to their composition there are two points which are highly important:

1st. Is it wise under all circumstances to maintain the protein of the ration up to a high standard, and secure a narrow nutritive ratio, no matter what are the prices of nitrogenous feeds?

2nd. What value shall we attach to the manurial ingredients of cattle foods? Shall we pay a high price for a particular feed on the basis of its large content of nitrogen, phosphoric acid and potash?

These questions are pertinent just now. The oil meals, which are the best calculated to reinforce the protein of the ration and to which we attribute high manurial value, cost from six to ten dollars more per ton than do the gluten feeds, the brewers' residues and some other feeds. The concrete, practical inquiry is, shall we buy the oil meals, under these circumstances?

I could propose to myself no more difficult question, and it is possible that I may fail to give a reply which you will regard as satisfactory.

Here is a specific problem in ration making as a basis for the discussion of this phase of our subject. Some farmer among you has hay, largely timothy, a sufficient supply of good silage and but little grain, and is anxious to know what feed he can most economically purchase. He can buy at the following prices, we will assume, which are a ten per cent advance on those recently quoted to me for car load lots: cotton seed meal $21.50; linseed meal $24 (assumed); King gluten meal $17; Buffalo gluten feed $15; malt sprouts $11.50; winter wheat bran $14.30; standard fine middlings $13.50. The prices may have changed, but they serve my purposes for illustration. This farmer proposes to feed 10–12 lbs. of hay and 30 lbs. of silage daily, and is in doubt as to whether he should or should not purchase the high priced feeds in order to easily maintain a rigid adherence to the German standard or whether he may vary from it in consideration of the lower price of certain feeds not so high in protein.

What is this German standard? (Explain). Is it definitely known that a nutritive ratio of just 1 : 5.4 is exactly the most economical combination of nutrients, any variation from which will seriously impair the efficiency of the ration? It certainly is not. For years agricultural chemists have told farmers that this ratio is only a suggestion based upon the most accurate data at command. No man is wise enough to safely declare that for many cows a ratio of 1 : 6 may not be just as good, or that for other cows a ratio of 1 : 5 may not be better. Certainly Station experiment and the best practice ratify the conclusion that with average cows it is generally desirable to feed somewhere between two and 2¾ lbs. of digestible protein daily, this amount to depend somewhat upon the animal and the price of foods.

My own judgment is that only a minority of cows will pay a relatively larger profit on the highest priced protein, bought in

order to keep up to a narrow nutritive ratio. On the other hand there are cows which make so good use of raw material that they will return the largest profits on the best ration. High grade rations are consistent only with high grade cows. I seriously doubt, therefore, whether with two-thirds of your cows, it is profitable to purchase the most costly nitrogenous bye-products in order to secure 2.5 lbs. digestible protein daily, when the lower priced goods will easily give you from 2 to 2¼ lbs. or even 2½ lbs. It is even questionable whether it is necessary to feed the more expensive forms of protein in order to attain a ration of maximum efficiency for any cow.

Let us now consider the list of foods in the relation of what they are to what they cost. I have here a table of figures showing the points I wish to bring out.

| | Price. | Amount digest. dry matter in ton. | Amount digest. protein in ton. | Cost of digest. dry matter. | Cost of digest. protein. |
|---|---|---|---|---|---|
| | | *lbs.* | *lbs.* | cts. | cts. |
| Linseed meal | $24.00 | 1440 | 600 | 1.67 | 4. |
| Cotton seed meal | 21.50 | 1398 | 740 | 1.54 | 2.9 |
| King gluten | 17.00 | 1490 | 640 | 1.14 | 2.6 |
| Buffalo gluten | 15.00 | 1485 | 430 | 1.01 | 3.5 |
| Malt sprouts | 11.50 | 1206 | 420 | .95 | 2.7 |
| Brewers' grains | 12.00 | 1140 | 440 | 1.05 | 2.7 |
| Winter bran | 14.30 | 1074 | 250 | 1.33 | 5.7 |
| Standard fine midds. | 13.50 | 1390 | 268 | .97 | 5. |

If we were to buy these materials for the nitrogen compounds alone and ignored the carbohydrates and fats which they contain, we would get a pound of digestible protein most cheaply in King gluten (2.6 cts) dried brewers' grains (2.7 cts.) dried malt sprouts (2 cts.) and cotton seed meal (2.9 cts), whereas in the other feeds in the list the pound cost would vary from 3.5 to 5.7 cts.

If we reckon cost on the basis of total digestible matter then the four cheapest foods are dried malt sprouts, fine middlings, brewers' grains and Buffalo gluten, King gluten coming prac-

tically into the same class. If we combine our two sets of figures the King gluten, brewers' grains and malt sprouts have a decided advantage over all the others. Linseed meal is costly on both sides, and unless it has a very material value that is medicinal or physiological, it can hardly be called a relatively economical feeding stuff at the present time.

Just here, someone remarks, "Those calculations are too fine for me. I can't feed my cows on any such nice mathematical basis." Perhaps you cannot, but you must if you are to attain the highest success.

The largest praise that can be given to modern agriculture is to say that it has come to be an art demanding nice calculations. Any business commands our respect in proportion to the thought and intelligence that must be applied to it.

Now is it possible for our farmer with his ten or twelve pounds of hay and thirty pounds of silage to use these lower cost foods and get good results in amount and quality of products and the welfare of his animals? I think so. Just here you rise to object.

You say gluten and these dried brewers' residues are not healthful foods. My reply is that the case is not proven and the probabilities are all the other way. The compounds in these waste products are essentially those of the corn and barley from which they were made, accompanied by much less starch. Last winter we fed to eight cows for three months, a grain ration made up wholly of malt sprouts, brewers' grains and gluten feed. The animals remained healthy and the milk was sound.

Combined with a generous proportion of hay and silage, four lbs. of middlings, two lbs. of malt sprouts, and two lbs. of high grade gluten meal, is an example of a present relatively low cost grain ration as large and as nitrogenous as the capacity of a great majority of our cows will justify.

This is not a plea for any especial waste-product feeding stuff, but is an attempt to show you that you are free to select from quite a large list of materials in order to reinforce your

farm protein without detriment to your cows or to your business, unless possibly, if you are making fancy butter, a higher type of flavor and texture might be developed with a different ration. I make bold to suggest that along with this great care about the doubtful effect of particular feeds, you should, in order to be consistent, be sure you are using the most expert methods of manufacture. More butter is spoiled after it leaves the cow than before.

You cannot expect me to wholly ignore the old, time worn question of specific rations for specific purposes. I am sure some farmers in Vermont are still asking for a ration for milk and another for butter, and are still vigorously denying the assertion which men of science sometimes make that the ration has little or no influence upon the quality of the resulting milk.

I have little hope of stopping this denial. No false notion has so persistently clung to agriculture as the one that a farmer can dictate to the cow what kind of milk she shall give. Perhaps it can be done when we are a great deal wiser, but I desire to assert from this platform in the most positive terms that no man, either scientist or farmer, is to-day wise enough to tell you how, short of actual abuse, you can by a manipulation of rations turn the cow from the lines that breeding and development have established. The exact experiments that have been conducted relative to this point have given results that are a mass of inexplicable confusion, with the testimony, in so far as it has method and order, in favor of the assertion that the cow's product is determined by her individuality rather than by her food.

One piece of advice is sound; feed a good cow generously with a sensible mixture of foods; feed her for milk when you want butter and feed her for butter when you want milk.

Her milk will sometimes vary greatly in quality from day to day from unknown causes. Sudden changes in environment and food are known to produce temporary changes in the milk solids, temporary rather than permanent I feel confident, but in

all these fluctuations you must first and last pin your faith upon the fixed qualities of the animal with which you are dealing.

I cannot leave this subject of the purchase of commercial feeding stuffs without uttering a warning against the so-called condimental foods. Early and late have we plead with farmers to stop paying from $150 to $400 per ton for materials having no more nutritive value than bran, linseed meal and other common commercial articles, and no medicinal value that is worth regarding, and yet the waste of money goes on. How do I explain this persistent following after the glaring absurdities of patent foods and patent medicines? Simply that man has always been trying to obtain something for nothing, and this will no more stop than sin will stop and righteousness become universal.

I suppose we shall keep on buying a little fennugreek and salt mixed with much bran, at marvelous prices and then curse the tariff or lack of tariff for our misfortunes.

So far in this discussion we have been concerned with the nutritive value of cattle foods and have left out of account the value of the manurial residue. The latter is certainly an important factor in the purchase of feeding stuffs, and is one much discussed in these latter years. We have been telling farmers that the nitrogen of the manure heap will serve as raw material for crop production just as will the nitrogen of commercial fertilizers and that just so far as we save this nitrogen or add to it by the purchase of grain we avoid the necessity of resorting to the superphosphate bag. We have also laid great stress upon the differences in manurial value of different foods, as for instance between corn meal and cotton seed meal, and have advised that these should be taken into account in estimating what are the most economical materials to purchase. This is sound doctrine. Other things being equal the grain food to buy is the one richest in nitrogen, phosphoric acid and potash. But how much actual cash can we afford to pay for those ingredients of plant food and then trust them to the vicissitudes of the stable, the manure heap and the field before they are actually brought

into use? The answer to this will depend somewhat of course, upon the care we exercise in preserving these valuable compounds that come into our possession.

We cannot avoid some losses, however, such as come from a variety of fermentations, from leaching and from soil drainage. Notwithstanding these chances for waste, we can afford to invest in feeding-stuff plant food providing it does not cost too much. Cotton seed meal is the concentrated feeding stuff having the highest manurial value. It excels the other materials mentioned by the following figures, reckoning nitrogen at 12½ cents, phosphoric acid at 4½ cents and potash at 4½ cents per pound. The excess of cost of cotton seed meal is also shown:

| | Excess manurial value. | Excess cost. | Balance in favor manurial value. |
|---|---|---|---|
| Linseed meal | $ 3.40 | $2.50 | |
| King Gluten | 6.27 | 4.50 | $1.77 |
| Buffalo Gluten | 9.98 | 6.50 | 3.38 |
| Dried Brewers' Grains | 9.79 | 9.50 | .29 |
| Bran | 11.57 | 7.20 | 4.37 |

The greater plant food value of the cotton seed meal comes largely from its high percentage of nitrogen, the one element most subject to loss. Leaving out linseed meal, the excess of plant food in cotton seed meal over the four other materials would actually cost, at the ruling prices for feeds, 76 per cent. of its present market value. If we take into account the many chances for waste, especially in the usual indifferent methods of managing barn yard manures, the greater expense of handling them, the inability to apply them as directly to specific uses as is the case with commercial plant food and the slower returns from them, we strongly doubt if the greater manurial value of cotton seed meal justifies its present larger cost.

I recognize the fact that this paper has dealt to some extent with market conditions which, while they have prevailed for nearly two years, may be only temporary. My purpose has been

larger, however, than to discover the present cheapest ration for milk making. In presenting this subject as I have, my aim has been to bring to the front the important elements of many problems that face the milk producer and so help him to correct conclusions in all the complex conditions which necessarily attend his labors. I have tried to show in a simple manner just how the potential energy of the farm may be realized and conserved. The tendency in agriculture is now away from the reckless buying of plant and animal foods that prevailed in the days of better prices for farm products, and I have sought to point out one way of more fully utilizing home resources.

## DISCUSSION FOLLOWING PROF. JORDAN'S ADDRESS.

The discussion opened by Hon. J. O. Sanford.

Mr. Sanford—I have been interested in this lecture. During its delivery I tried to find wherein we might criticise or confute the theories brought to us by our friend from New York, but I have been unable to do so. I accept as true everything he has presented in his excellent paper. As your president has said, there is no subject of greater importance to the dairy interests of Vermont than that of feeding the cow. We are all students in this matter. And yet we are not very wise after all. We have not advanced far toward perfection in the feeding of our dairy stock. We have learned much, yet much more is still unlearned. We call the different nutrients in cattle feeds by their proper names, we know more or less where to find them; but do we apply this knowledge wisely? Let us consider "where we are at." What are our prospects? We are raising crops upon our farms as best we can, yet are buying $2,000,000 worth of cattle feed yearly in this State. The question is asked, whereever we go, as to whether this is right or wrong. Wherever we meet the merchants and dairymen throughout the State they say this is all wrong; but is it? It is certainly wise to grow as much of our cattle food as possible, yet rational purchase of grain food is also wise. Irrational buying, the purchase of what

we already grow or may grow in abundance is the height of folly.

I have got new ideas to-day from the speaker which I am going to carry home and practice. We want to take these fundamental truths for our foundation and build upon them the best we can. To feed a high grade ration to a low grade cow is absurd, but the majority of us are doing it. We want to understand how we can produce more cattle feed upon the farm, and buy less. Can we not sell some carbohydrates in exchange for protein? I believe it is a good thing to do so. Hay is a good thing to raise and to sell. I have an over-abundance on my farm. I have followed the practice of selling hay, but for every ton of hay sold I have returned far more than its equivalent of protein and of nitrogen, which we need for the increased power of our farm. When we have exchanged our hay for other substances that contain more protein, we then want to make the best possible use of it in our feeding practices. We should also consider the manurial value of these substances.

We want to grow our hay, we expect to feed in the very best possible manner and to cut it early while it contains the most protein. We have been told that if it is cut during a certain stage, before it becomes too mature, it contains more protein than at any other time. Let us carry this out in the cutting of our hay.

To get the most out of this discussion this afternoon I would advise running it along these lines. You know your experiences, and what you want. Do not hesitate to ask questions. The professor will be only too glad to answer.

I will ask the professor if he does not think it practicable for us to make great improvements in the way of producing more hay upon the farm, growing a better crop and curing it in a better condition than we do? Can we not produce more protein?

Prof. Jordan—There is but one reply, which is that a great deal more can be done. Common red clover is a valuable plant, but it is seldom brought to its full use. We secure a good

crop for one year, the next year less, and the next year none. A more rapid rotation in farming would be profitable for many. Where we have a rapid rotation, clover may occupy an important place.

In regard to peas, it is safe to state that they are invaluable as a part of your summer soiling. When raised for the grain you know, of course, that peas do not yield a large number of bushels to the acre, 20 bushels being a large crop. Some farmers claim they raise 30 bushels to the acre, but this is exceptional. There is, however, no grain on the farm, when we take into consideration its digestibility, that is worth more, pound for pound, than peas. They are exceedingly digestible, and highly nitrogenous.

To answer the gentleman's question in a brief, broad way, I say yes, much more protein can be produced on the farm.

Question—What can you say to us in regard to cutting our hay earlier?

Prof. Jordan—Hay cannot all be cut at one period of growth. It is doubtful if one can improve upon the practices now followed by the best farmers. The first hay is cut rather early and the last rather late, palatableness and yield both being considered. When you cut timothy very early you get material that is more digestible pound for pound than late cut hay, and a little more protein for the weight, but you get much less hay. I am inclined to think medium cutting is about right.

Mr. Sanford—Where you cut the hay early you can cut a second crop.

Prof. Jordan—Not always profitably in New England. It is not advisable to cut clover too late, after the falling of the leaves, but both clover and timothy are often cut too early.

Mr. Sanford—Some of our people think by cutting it early they can get another crop, and consequently get more hay in reality than where it is allowed to stand. The oats and peas are a great help to us. When raised in the best possible condition they are a grand crop.

A Member—Is alfalfa clover the same as alsike?

Prof. Jordan—No, alfalfa is a second cousin to alsike.

Question—Is alsike as good as other clover hay.

Prof. Jordan—I so regard it. No hay is eaten more readily. As an aid to soil fertility I doubt if it has the value that red clover has.

Mr. Sanford—Do you believe in mixing clovers?

Prof. Jordan—No. If you are depending upon clover to restore the soil it is advisable to sow the red, but there is no clover more palatable and desirable as a fodder than alsike. But an estimate of the nutritive value of a cattle food should not be based wholly upon the way the cow relishes it. I have seen western steers refuse cotton seed meal for a week, but when they came to like it it was a valuable adjunct to corn in fattening them.

Question—Would you recommend peas and oats for a dry food as well as for soiling, sowed together and cut early and put in the barn for winter feed?

Prof. Jordan—I am not clear in my mind which is the wisest thing to do, to cut the peas and oats at a time when they will cure and make nice hay, or let the peas and oats mature and thresh. Much depends upon circumstances.

Question—I have been in the habit of buying these small Canada peas and putting them with oats and cutting them when the peas were just about right for green peas.

Prof. Jordan—I have no standard of measurement as to the comparative value of cutting and haying, or of maturing the crop and using it as grain.

Mr. Sanford—The question of rotation is important, just what crop should follow another. For instance, what should follow corn? Since we have stopped growing oats in such large quantities I find farmers are raising rye, oats and peas, Hungarian, German millet or whatever it is called; anything they can find in the seed catatogue as being desirable. I was glad to hear the professor cautioning us to go carefully in the use of new and untried forage crops. I never saw Hungarian

that would compare with our mixed grasses. Now in regard to rye for hay, there is just five minutes when you can cut rye and have it right. I do feel that first of all—and I want to emphasize what I say—we should make a better use of the old standard crops which we know we can handle successfully rather than hunt for novelties. That is the way I feel, and I am glad to know the gentleman recognizes this as a fact in the paper he has given us.

Mr. Tinkham—The thing that bridges over that place, to which Mr. Sanford refers in regard to our corn fields, is to sow on grass seed about the last of July and the next season we will have an excellent crop of hay.

We all took note in the course of the opening remarks of what was said about not feeding so much western corn. At the dinner table I asked that gentleman if he used western corn, and he said he did. Well, now that rather took off the feather edge from his remarks for me. I should like to have you call on Mrs. Nelson for her experience in buying grain.

Mrs. Nelson—I am too poor a farmer to come up and talk to you people here for I have not been able to employ a threshing machine for the last seven or eight years, and more than that I have not husked any corn more than once in the last five years. This present year I have paid $675 for commercial feeds and grain for my entire stock. At present I have 62 head of cattle and 4 horses. This grain was fed in fattening my pork, and fed to my hens, horses and cattle. I have 27 cows at the present time. Of course it took in the vicinity of $200 to feed the horses and poultry. I paid $111 for what oats I bought and that all went to the hens and horses, and the cracked corn to mix with it would probably take in the vicinity of enough to make it $200. My dairy brought in butter between $2,200 and $2,300.

Sec. Pierce—What was the average per cow in pounds of butter?

Mrs. Nelson—Three hundred and twenty-nine pounds, and in dollars $61.52 per cow out of the butter.

Sec. Pierce—You think it is profitable to buy western grains, do you not?

Mrs. Nelson—I do not think it is profitable for me to hire help to raise it. I do not know but I am wrong, because I have not had experience in raising grain. That is my experience this last year.

Mr. Tinkham—Have you got any money left?

Mrs. Nelson—I had enough to bring me to St. Albans on a round trip ticket, and shall be able to pay my help next year out of what I have left.

Prof. Jordan—That is a combination that cannot be beaten; a smart woman and a lot of good cows. A cow that will make 329 pounds of butter will return a profit on purchased grain. I believe in feeding cows well. My point is this, that we have practically the same capacity for the production of carbohydrates that they have in the West, a capacity that is underestimated and under-worked to the advantage of the Kansas corn producer.

Mrs. Nelson—I calculate it costs me $11.50 per cow for the grain ration of my dairy.

Mr. Currier—One point is quite evident, and that is that you are heaping abuse upon the cow. You say you are paying $2,000,000 for cattle feed. This lady says that $200 out of the $675 has gone to the horses, and hasn't as much more gone to the pigs? Do not charge the cows with more of this grain than they eat.

Question—I would like to ask Prof. Jordan if he supposes any of these high grade cows will produce 329 pounds of butter per year on a feed of hay and corn stalks without grain or corn meal such as we feed our cows. How much of a cow will it take to make 329 pounds of butter a year upon a ration with a nutritive ratio of about 1 to 12 or 14? How wide a ration can we profitably feed our cows?

Prof. Jordan—I did not say we should not buy any grain, and I did not even hint that we should feed a ration with a ratio of 1 to 12. The point I tried to make was this; that the

production of our carbohydrates is the easy production of the farm, and that if we buy at all it should be with preference to other nutrients. You cannot bring a cow up to 329 pounds of butter and not feed grain, and I would buy grain freely if necessary for animals of that grade.

The problems of nutritive ratios are not yet all solved. The facts so far as known indicate that the ration for milk should not fall short of two pounds of digestible protein, unless protein is unusually expensive. A ration rich in protein is especially stimulating to milk production.

Mr. Sanford—At what stage should corn be cut for ensilage?

Prof. Jordan—Wait until the kernel glazes in part, if the weather is moist enough so the corn will not get dry.

Question—We were told by a New York man that corn should be dried before it was put into the silo in order to make good ensilage.

Prof. Jordan—All New York men do not think alike.

Question—How much digestible protein does the cow get with timothy hay, and the corn products alone?

Prof. Jordan—If you are feeding six pounds of cob and corn meal, thirty pounds of ensilage and ten pounds of timothy hay daily, the ration contains about a pound and a tenth of digestible protein.

Mr. Tinkham—I would like to ask Mrs. Nelson what her grain ration is, and have Prof. Jordan tell us how that compares with his ideas.

Mrs. Nelson—The ration I have been feeding is corn meal and bran, equal weight, two quarts twice a day.

Prof. Jordan—You are feeding just about five pounds of grain daily. How many pounds of ensilage are you feeding?

Mrs. Nelson—I do not know how many pounds, but about a bushel of ensilage.

Prof. Jordan—That would be about forty pounds and five to eight pounds of hay perhaps. Certainly this ration could be

improved by purchasing some one of the nitrogenous foods in place of part or all of the corn meal.

Mrs. Nelson—The gentleman to whom I have sent my butter does not talk favorably of gluten.

Prof. Jordan—If it was my case I would put in a more nitrogenous food.

Mrs. Nelson—At the price of corn meal compared with other feeds do you think I could put in the gluten?

Prof. Jordan—I do.

## THE RELATION OF THE STATE BOARD OF AGRICULTURE TO THE FARMERS OF THE STATE.

BY HON. V. I. SPEAR, SECRETARY.

*Mr. President, Ladies and Gentlemen :*

It was not expected that I should take very much of the time of the Vermont farmers and dairymen in trying to solve the problem of their relation to the State Board of Agriculture. It seems to me, to attempt any solution of that proposition would simply be to ascertain the relation which exists between a part and the whole. The State Board of Agriculture is composed of a few farmers of Vermont, who are perhaps as distinctively farmers as any equal number of men who can be picked up. As I look back over the past seven or eight years that I have been permitted to be upon this Board there have been but two or three persons upon this Board who have not been living upon the old farm occupied by their families for some generations. To try to separate the Board from the farmers of Vermont—I do not think the Board would consent to any such division even if the farmers wanted to.

There has been imposed upon the Board of Agriculture by the Legislature from time to time, certain duties, certain requirements that the ordinary farmer is free from ; and as I was looking over this topic, thinking I would have but five or ten minutes to say something upon it, I thought perhaps I could occupy the time in calling to mind some of the things that it is required that the Board of Agriculture here in Vermont should do. And so I have looked over the various acts of the Legislature of Vermont to see what was required of this Board. I found that the first requirement was that the Board of Agriculture should be appointed for the improvement of the general interests of

husbandry and the promotion of Agricultural education throughout the State, and for the discharge of such other duties as are hereinafter set forth, etc. Then follow some duties among which it is stated that the Board of Agriculture shall hold one meeting in each county annually and others if expedient.

Those two sections, for a period of twenty years, covered all the duties that were required of the Vermont State Board of Agriculture. All the other wordings of the acts were simply in the way of definitions, but the Board of Agriculture, as created twenty-five years ago, was for improving the husbandry of the State and was required, for the performance of that duty, to hold meetings in the various counties.

Since its organization it has performed the duties allotted to it in a more or less satisfactory manner. They are, in a certain sense, the educational factor of Vermont agriculture. It is the business of the Board of Agriculture to investigate new principles and new theories and, in connection with our Experiment Station, to try and put before the farmers of the State some new light and extend to them all the encouragnment and all the help they can. In doing this the board becomes simply the servant of the farmers of the State. They are for the time being, for the time under which they are appointed, at the service of the farmers. They are made to be the servants of every farmer in this State just as far as their intelligence and ability enables them to be helpful.

Then as I followed along I found that later the board was required to do some more work. I suppose the board had performed some of their original duties pretty well and it was thought they could do more, and so it was provided that the "Board should collect statistical information relating to the resources and attractions of Vermont."

Under this provision there has been required a great deal of hard work from the Board of Agriculture. The board has by this act been made the agent through which the State could keep in touch with all the valuable information that it has been required to prepare. It has been and is here in Vermont the

agency or bureau of information and as such is required to make a list of our farm property that has been neglected, or not used. We all know how much we heard a few years ago about abandoned farms. There is not so much said now, there is not so much to say; but along that line there has been a good deal of work for the Board of Agriculture to look after. They have been helpful to some extent in extending information regarding Vermont to people outside who were disposed to come here to spend their summers.

This takes us up as far as 1892. Then the session of 1894 gave another little hitch to the Board of Agriculture, and said that the Board of Agriculture of the State of Vermont should be constituted the Cattle Commission of the State. Now under that provision the work of the Board has been greatly increased. The Board of Agriculture in this way becomes the medium through which the farmers in the State can have inspection of stock and have it done at State expense. The labors that have been performed by the board in this connec tion have been, like the others, done along those lines that seemed to them to be the most practical and for the interest of the State and the good of the farmers. I believe, in speaking of this matter for myself and associates, that there has never been any purpose on the part of the board, in any act it has been called upon to do, except to extend help and assistance to the farmers of the State just as far as they have been able to do it.

Now in so many ways, in having to come in touch with the farmers of the State, it has been a matter that has carried with it considerable responsibility, and I believe I voice the sentiments of the board entirely if I say for them, that in all these things we have been very grateful and have felt under great obligations to the people of the State for the very kind judgment with which our shortcomings have been judged. We have realized more fully than any farmers in the State could have done, how far from perfect our work has been. It spite of those shortcomings I believe there has never entered into our work anything but an effort to discharge our duties in as faithful and

thorough a way as possible. This I wish to say simply in acknowledging what I believe to be the feeling of my associates. and myself. We have been here and listened to able discussions, and we have had solid food dished out to us, more than we can take home and make full use of, and I do not need to intrude upon you any further remarks. The subject as assigned was more especially, I presume, to give opportunity for the Board of Agriculture to thank the farmers for the kind treatment we have received.

## GOVERNOR GROUT'S ADDRESS.

*Mr. President, Ladies and Gentlemen :*

If I had known the rivalry that has been mentioned I should have undoubtedly arisen at four o'clock yesterday morning, with the mercury over in our section at twenty-eight below zero, and made my way here in season to have been handled by gentler agencies than those which have presented me, though the treatment has been very kind as it is. But not aware of it, I thought to take the next best chance, which was to have the day at home about work that needed attention, and start at 4.40 last evening, reaching here at 9.00. Judging from the fullness of the programme I thought I would be in season, but the air line from Boston was an hour late, so you see my plans failed in that respect and I am here to-day instead. Just why, is not so clear. Some have said "they want to see the Governor." Well, that is all very nice, but my good people if you want to behold your Governor as a public exhibit you should elect a better looking one than you did the last time. But in this respect, however, you may be sure that from the depths of sincere gratitude I am as glad to see the people whenever I can as it is possible for them to be pleased to see me. But it is not to see me. It is to witness the official halo that circles about the office. It is, I suppose, to see the dignity and honor of official station, and in this I cangratulate you, because underlying it there is a well grounded patriotism that belongs to every peace-loving, law-abiding community.

When one is expected upon public occasions, to say something, it is very convenient to have something to say: and I am before you in absolutely the most destitute condition in this respect, as will be seen before I am through. I have had

no time for any thought and whatever I say will be as a free-will offering, and what it will be the Lord only knows. Of course a scholar should get his lesson and the scholar that goes into class with a poor one deserves a cut, but I am trespassing upon your good nature, expecting as kind a deliverance as I have already realized as to the misconduct or delinquency visited upon your Association in getting here.

Now this Governor business is not quite out of my mind yet. It makes me think of an item I saw in the paper the other day which I expect you have all seen. A professor once upon a time, down in Kentucky, asked a blue-nose if they had microbes in their drinking water down there. The blue-nose replied, he did not know what the educator meant, had never heard of any such a thing. What, asked the professor, never heard of microbes? No, said the blue-nose, drinking water. (Laughter.) The business of farmers' meetings is something I know but little about; but being in it a trifle just now will assume the object of this meeting to be a betterment of the condition of the agricultural classes, and to Vermont that means a great deal. You come together upon these pleasant occasions, afforded you at a time when you can best be away from your homes, to learn a little more about your life work; to know how, if possible, after returning home, to do it a little better. I never have seen anything yet in this world so perfect that you might not pass a word of criticism concerning it. This idea will hardly be new to the Vermont Dairymen's Association as far as I am concerned. You come here and listen to the ablest talkers, the best thinkers, upon the subject in question. You receive a great many good thoughts, many of them practical, but, my friends, unless you are careful, unless you sort; unless you select, unless you listen with a little of criticism, you are liable to go home inflated with too much theory. You are liable to go home with some new thing in mind that you think you will have, which is almost unattainable and which under your circumstances and the arrangements you have for doing your work and the condition you may be in generally, will be

entirely impracticable. Now you may be sharper and smarter in this respect than I have been ; but in years passed I have listened to theories given by these learned professors who know so well whereof they speak, and I went home to reduce them to practice at quite an expense, which I thought afterwards ought to have been incurred at the Experiment Station so I could have had the practical result to go by instead of theory, and then if I wanted to burn my fingers it would be my own fault.

This is only a word of caution to the average attendant upon these meetings. You have come here though, to learn, and I see here faces that I saw at the first meetings I ever attended and probably I shall continue to see these same faces as long as I appear here for I hope the owners will never die, and so are still learning. Yes, and this work of the farmer that he carries on back on the hill, in a quiet, modest way is filled with more difficulty, is intrinsically more obstruse and is learned by longer travels, journeys and experiences, than any other art you can find practiced by the industries of earth. (Applause.) And still they say that the smart boys should be sent away to the college, pushed away from home to make their living, and the Johns and Jims at the foot of the family class, stay and run the farm. Though the case is a neglected one, the Johns and Jims staying at home, when through with their earthly career, can "stack up," so to speak, with the best of them, those sent away for better chances and greater gain. So you see there is a compensation that comes from the quiet industry that belongs to the plodding farmer's life.

Well, now, if we are to learn at these meetings, what should it be? It should not be anything in romance. It should be something actual. We should learn, in a broad sense, to hold the plough a little better than it has been held in the past. I mean by the plough the cultivation of our soil. We should learn how to accomplish the year's work on the old farm a little better. It is simple to do this ; it means to raise a little better corn field than you raised last year ; it relates to avoiding mistakes in the potato crop ; it relates to the question of cutting your hay or harvest-

ing your crops better than ever before, and whether you would have your hay worth something, or almost nothing, when you have secured it. And it relates to divers other things. As to stock, the kind of cow you will have; whether you will continue raising horses, and if you do, whether you will have the gambrel shanked trotter, or the brocky work horse. The farmer wearies in all these undertakings and sometimes sits down to rest while things move on around and past him; and when December comes he has not the six fat hogs to sell, perhaps only two; or he has been milking eight cows when he should have handled 16 on the soil he has been tilling. And so on through the chapter of such things that influence your income. You come here to study and solve these and the other problems of the busy lives you are leading as farmers.

So much for that suggestion. You have a better portion than all this. It is something above it, upon a higher plane, and commands deeper thought. It is something that throws its rootlets deeper into the soil of the farmer's life and heart than anything else. My friends, it is the farm home. The place where the mother dwells and where the father comes in occasionally; it is where the children come along; and the place where the men and women of the future are being made. This is possibly neglected as much as almost anything you are doing; you do not take the child quite right. You do not begin in season to find his way, and yield yours to it, so that as he grows to be a man he becomes imbued with a feeling that, though he has travelled the earth over and seen it all, there is no place like his old home; there is no better State than his native State, and there is no better business than that in which he was brought up. I think there may be some neglect here. I believe I have seen it, and this means more than the other criticisms I mentioned a moment ago, for so many of our bright boys and girls as soon as they have wings strong enough, fly away to other localities.

I will not take more of your time, for you have some one here who can interest you, and you know the fellow who does

not have anything to say, never knows when he has said it. I will then hasten to a conclusion, and say to you as Vermonters, as people of a State we all love dearly, and as farmers engaged in a great work, ranking above all others, and in which our highest minded, best hearted and strongest specimens of manhood should be found; that you should do whatever you do, well; do it at the best. Have the best cow, have the best hog, have the best sheep, have the best horse, have the best of everything that you possess and let your neighbor do likewise, and there will be a rivalry soon that will place you on an elevation beyond what many of us are enjoying to-day. Do whatever you undertake at your very best, so that you will continue to be proud of your neighbor, satisfied with yourselves, more deeply and patriotically interested in the State where you live; and, following it out a little further, in the nation, the great nation of which that State is a member, which is the proudest power on the face of the globe to-day. You want to grow up into a better manhood and a better womanhood, a better citizenship, a stronger, purer, more enlightened patriotism, which is the foundation of all that we stay on earth for.

Thanking you ladies and gentlemen for your kind attention I will not bore you longer. (Applause.)

# THE FERTILITY OF THE LAND.

BY PROFESSOR E. B. VOORHEES.

In a discussion of this subject at this time and before such a representative body, I am satisfied that the need is not so much for statements of underlying principles, as to point out the importance of their application in our every day business of farming. To be sure, we must have the principle upon which to base our action, but that stated and clearly understood, the chief thing is to know what to do with it.

In this matter of soil fertility, so all important, not only to the farming industry, but directly or indirectly to all others, and thus possessing an interest for all classes, whether they know it or not, the first question that interests us is: What is it? What constitutes this peculiar thing called "fertility," upon which so much depends? Is it an evanescent substance that must be coddled and handled with the greatest of care, in order that it may not escape? If so, the next question is: What becomes of it? What means this continual discussion concerning the exhaustion of soil? Are we as a nation of farmers not only losing by natural means, but willfully wasting, the real capital stock of our country? Do we as individual farmers lack in our appreciation of this "something," which measures our greatness as a nation? For we are to remember, that the primary source of our wealth is in our land. If this view be either true or false, it is in any case worthy of our careful study, and if it be a matter of such great importance as we are sometimes led to believe, we should know not only *how to use it*, but *how to use it most economically*, and if the need exist, and it frequently does, particularly in the east, we should know how to increase it. The discussion of this subject is, therefore, naturally divided into four distinct parts.

1. What is fertility?
2. What becomes of it?
3. How shall it be used to the best advantage?
4. How shall it be increased?

### I. WHAT IS FERTILITY.

With this general and cursory view of the possibilities of this something called "fertility," let us look for a moment at the first point—what is it? Webster says "it is the quality of being fertile," and that to be fertile is to be "productive," which simply leads us to inquire for a more detailed definition of the term, and to study more closely the conditions which cause productiveness. In the first place, a soil must contain those elements found in the plant; hence, it is almost self-evident that a fertile soil must contain an abundance of those elements or constituents which are likely to be reduced below the point of profitable cropping by the continual growth and removal from the land of the crops grown, and it has been demonstrated by careful experiments, that the number of elements is limited in many cases to three and at most to four, viz.: nitrogen, phosphoric acid, potash and lime, the latter only in exceptional cases. It has also been shown that it is the one which exists in minimum amounts which measures the fertility in this respect, as one cannot be substituted for another. We know, however, that there are soils so rich in all of these elements that if the crops depended upon them alone, it would require centuries to exhaust them, while actually they are now incapable of producing a single profitable crop of cereals, fruit, grasses, or other general products of the farm. It is evident, therefore, that the elements of fertility in themselves are not sufficient to constitute what we understand by the term—fertility is not measured by them alone; associated with them there must be other conditions. That is, while crops cannot be grown without these elements, however favorable other conditions are, it is the conditions which surround them that measure the power of the crop to secure them. For example, water is absolutely essential both for the solution of these elements in the soil, and for the dis-

tribution of the food in the plant after it has been acquired. The temperature of both the soil and surrounding air is another prime factor, as the changes which go on in both the soil and in the plant are influenced by it, and hence the location has an important bearing upon the productive powers of any soil. With these attributes, still others are necessary, chief among which are the susceptibility of the soil particles to the action of these agencies, and if its original character is such as to readily give up its constituents; whether hard and compact, and impervious to water, air and warmth, or open and friable, and freely admitting these agencies; besides these there are many minor properties which, together, constitute what is understood as "condition."

Furthermore, fertility even in this true sense may be useless, because of the location of the land which possesses it. For example, there are many localities on this continent in which sugar-cane will grow to perfection, because the soils are very rich in the fertilizer elements, and because the surrounding conditions are most favorable, yet because of their location, it is unprofitable to grow sugar. In the first place, they are so situated as to make it impossible, or impracticable, at any rate, to provide the means necessary to convert the sugar producing crop into actual sugar; and in the second place, even if were possible to do so, the distance from shipping stations and from markets so increases the cost of transportation as to make it unprofitable to compete in the market with that grown upon lands possessing true "fertility" in a lower degree.

Practical fertility is, therefore, dependent upon many conditions, and fortunately our own country possesses them all in a marked degree, that is, the utility of the potential fertility, as represented by the total mineral content of our soils, is such as to make us one of the greatest agricultural nations in the world, in both the quantity and variety of products grown. Our soils possess the essential elements in lavish amounts, and our climate permits of its easy conversion into a wide series of valuable products, and our location and facilities for handling and distributing our produce are such as to enable us to compete in any market in the world.

There is an element of danger, however, in the possession of this great natural wealth, lest it not only beget but foster national and individual carelessness, since frequently carelessness is the common attribute of great abundance. This suggestion will, however, receive attention later in the discussion.

## II. WHAT BECOMES OF OUR FERTILITY?

Since fertility is dependent upon so many conditions, or in other words, since the essential elements of fertility are dependent upon their utility, and since in this sense it is largely determined by natural conditions, it is pertinent to inquire, first, whether under present systems of management or mismanagement ot the land, it is suffering any natural loss. As already pointed out, the most important function of fertility is to furnish nitrogen, phosphoric acid and potash, and since the content of these in our soils, together with the knowledge we have as to their use, measures in a sense our prosperity as an agricultural people, the possibilities of losing them from the soil are a matter of national importanee, and of vital interest to individual farmers, who in the aggregate make up that part of the nation directly affected by the results of such loss.

It would perhaps be possible by a careful chemical survey of our soils to determine both the actual and potential fertility of our entire country, and this, together with an accurate measure of the intelligence exercised in its use would enable us to safely predict our future development, if present methods were continued. That is, whether it would become barren and worthless, as has been the case in many older countries, which at one time were quite as productive, or whether it would constantly increase in productiveness, even with continuous and profitable cropping.

I do not wish to be regarded as an alarmist, for, because of our enormous resources, I believe that there is no immediate danger of our country as a whole, or in any part, becoming sterile, yet my observation and study have strongly convinced me that a real danger confronts us. It is now recognized by a few—the time is not far distant when it will be realized by many. Unless

the apparent apathy of the producer, who is directly interested, the lethargy of the masses, who are indirectly interested, and the insensibility, or perhaps better, senselessness of the average legislator, who in his attempts to appear to be both directly and indirectly interested, and then fails to represent anything, are awakened to a proper sense of the situation, disaster will sooner or later overtake us, because of our wasteful management of our fertility given us for the purpose of rightful use.

### SOURCES OF NATURAL LOSS OF NITROGEN.

In the first place, then, let us inquire as to the natural sources of loss from our land of the essential constituent elements not absolutely lost, because in nature what appears to be loss is a change of form and place, rather than loss, but in this case it is equivalent to an actual loss, because no future benefit is derived from at least a part of those that have escaped, though placed there for our use.

Of these constituents, nitrogen is in one sense of the greatest importance, because it is the one that is more liable to escape than the others, and because it is more expensive to supply artificially than are the minerals. It is more liable to escape because it is an element that is available as plant-food largely in proportion as it changes to a nitrate, and inasmuch as after it assumes this form, it is seldom absorbed or fixed in the soil. In this form it remains freely movable and the possibility of loss from leaching is very great, and the possibility of loss is increased in proportion to the lack of preventive measures, or the presence of those conditions which favor leaching. The latter may be classified as follows: First, the amount and time of the rainfall; second, the character and absorbing power of the soil and subsoil; and third, the amount of vegetation on the soil affects the passage of water through them. While the amount and time of rainfall cannot be controlled, its effect upon our soils in this direction can be largely governed if proper attention is given to correcting the other conditions which may be largely modified, if not controlled. In the mat-

ter of the absorbing and retentive power of soils, it has been shown that if they are well supplied with vegetable matter and carefully cultivated, they retain and hold the plant food constituents in a much greater degree than if devoid of humus and improperly managed, and also that the drainage waters from soils upon which crops are growing seldom contain more than the merest trace of nitrates. The addition of vegetable matter and good cultivation are conditions that are within the power of all farmers to provide, though it is sometimes impracticable to keep the land continuously covered with a crop, and sometimes it is thought that the loss thus incurred is more than balanced by the gain in other directions. The importance of these precautions is apparent and has been frequently demonstrated. For example, it has been shown by carefully conducted experiments, both in this and other countries, that in a season of average rainfall, the drainage waters carry away from one acre, from uncropped soils, and only fairly rich in plant food, as much as thirty-seven pounds of nitrogen per year, while when continuously cropped, the drainage waters from the same soils contain practically no nitrogen. This difference in the loss of nitrogen under the two conditions may not seem so serious a thing at the first glance, but when we consider, first, that the amount of possible loss, annually, is practically equivalent in nitrogen to that contained in two tons of timothy hay, or in one ton of either wheat, rye, oats, corn or buckwheat, quantities nearly double the average yield per acre of these crops throughout our whole country, and second, that the nitrogen which is carried away by the drainage water is in the very best form for feeding the plant, or it would not have been lost, and thus leaves the soil not only poorer in the constituent elements, but poorer in the sense that the remainder in the soil is in a less useful form, "he who runs may read" the danger in this direction. Assuming that but one-tenth of the arable land in our humid regions is lying fallow, or uncropped, particularly at those seasons of the year when our rains are usually the heaviest, early spring and late fall, the amounts that might be carried away by this

means would reach enormous totals, measured by tons rather than pounds. In fact, in many sections much more than one-tenth of the arable land is void of vegetation nearly six months in the year, and the losses are recognized as a serious matter; it is in those sections that the fertilizer agent reaps a rich reward.

Another source of natural loss of nitrogen is its escape as gas into the atmosphere, and is due to oxidation of the vegetable matter, or to "denitrification," and it takes place very rapidly when soils rich in vegetable matter are improperly managed. The possibilities of loss in this direction are strongly shown by investigations carried out at the Minnesota Experiment Station on "The loss of nitrogen by continuous wheat raising." The results of these studies showed that the total natural loss of nitrogen, annually, was far greater than the loss due to the cropping. In other words, by the system of continuous cropping, which is universally observed in the great wheat fields in the North West, there were but 24.5 pounds of nitrogen removed in the crop harvested, while the total loss per acre was 171 pounds, or an excess of 146 pounds, a large part of which loss was certainly due to the rapid using up of the vegetable matter by this improvident method. Whereas, on the other hand, when wheat was grown in a rotation with clover, the gain in soil nitrogen far exceeded that lost, or carried away by the crop. It is said that the trend of civilization is westward; the centre of agricultural production is also moving westward, and close in its wake is the fertilizer agent—he has reached the Mississippi river, and is selling nitrogen in the regions formerly believed to possess inexhaustible fertility; a result due in large measure to the losses of this element by continuous wheat and corn growing, and to improvident methods of preparing the soil for these crops. In the Southern States continuous cropping of cotton and tobacco is also responsible for untold losses in this expensive element of fertility. While in nearly every State of the Union soils both rich and poor are

suffering more or less from the effect of natural losses in this direction.

### THE NATURAL LOSS OF THE MINERAL ELEMENTS.

In the case of the minerals, phosphoric acid and potash, which exist in fixed compounds in the soil, the actual losses are undoubtedly very much less than is the case with nitrogen, since only traces of those constituents are ever found in solution in the drainage waters under ordinary circumstances, yet because of the large quantity of water that passes through many of our soils, the total amount of these rendered soluble and carried away by this means is very great. Our great rivers carry in solution into the ocean tons upon tons annually of these elements of fertility, and it is an absolute loss, as there is no natural means by which these may be returned to the soil, as is the case with nitrogen, and, as is the case with nitrogen, the soil is poorer by virtue of this loss not only in its elements of fertility, but in the immediate utility of the remainder. These silent and unseen forces, constantly at work, are reducing the contents of these constituents of our soils to an alarming degree, and it is because they are unrecognized that the results of their activities are not appreciated, and consequently are largely unrestrained.

### LOSSES DUE TO MECHANICAL MEANS.

In the second place a great natural loss of all the fertility elements is due to mechanical means; aside from the amounts the rivers of water are carrying in solution to the sea, they are carrying tons upon tons in suspension. In some sections these are restricted because they are apparent, yet the gullied and barren hillsides are standing monuments of our folly, and mute witnesses of our improvidence. The results are painfully evident in many of the southern states, and in sections where the forests have been removed and the land abandoned, the soils have been washed and gullied until not only the very best portions, but in some cases the largest portions, have been lost.

ARTIFICIAL LOSSES OF FERTILITY.

In addition to these natural losses, there are the artificial losses, or those due to the removal of crops. These, of course, necessarily accompany all farming operations, and provided that in the removal and sale of the constituents in the form of crops, the farmer has received a fair price for them, they are legitimate.

The sale of farm products is really in the last analysis a sale of actual constituents, together with a certain portion of the "condition" of our land, which is not readily measurable. That is, it is the constituents in the soil, together with the conditions surrounding it that the farmer buys when he buys land. If an acre of land containing within the reach of the plant roots, say 3,000 pounds of nitrogen, 5,000 pounds of phosphoric acrid and 6,000 pounds of potash, sells for $100, the seller receives the $100, not for so much dirt, but really for the constituents contained in it; the purchaser believes that with the conditions surrounding them he can convert them into products which he can sell and realize a profit. If in selling the same quantities of these constituents, a lower price per acre is received, it is because the natural conditions which surround them, and which influence their utility, are less favorable, and a greater proportionate effort is necessary to secure them in the form of salable products. At the price per acre and for the amounts here given, the buyer would pay at the rate of 1½ cents per pound for the nitrogen, and ½ cent per pound each for the phosphoric acid and potash, and it now constitutes his capital stock.

A comparison of the prices paid with the prices received for the various constituents in the different crops, disregarding for the moment the value of the "condition," will make this matter of rational sale, which represents a reduction of our capital stock, clearer to us. If, for example, wheat is raised and sold for 60 cents per bushel, or $20 per ton, the nitrogen sells in this form for 41 cents per pound, and the phosphoric acid and potash for 14 cents each per pound. That is, the 60 cents per bushel, or the 41 cents received for the nitrogen and the 14 cents for the potash and phosphoric acid, represent what has been received per pound

for the capital stock of these elements. The labor in raising the crop, the expense of harvesting and putting it upon the market, and the profit must come out of the difference between what is paid and what is received. Naturally, as the ratio between the constituents contained in the products sold, and the price received is increased, the rate of income per unit of exhaustion is increased, though in many cases the increased cost of the labor necessary is in proportion to the increased price received. This may be illustrated by a comparison on the fertility basis of the sale of wheat and milk. In milk at $1.50 per hundred, nitrogen is sold for $2.00 per pound, and phosphoric acid and potash for approximately 70 cents per pound. In the sale of milk at this price, the rate of income per unit of exhaustion is increased nearly five times, though because it is a manufactured product, the cost of labor per unit is largely increased. Again, if cream is sold, the prices received for the constituents are still further increased, while if the milk is made into butter, which is sold, the prices received measure the expenses and profit, and the capital stock of fertility is not reduced, but usually returned to the soil though in another form and in another place.

The losses of the constituents in the cereals and grasses are, too, relatively greater than in vegetables and fruits, as potatoes, sugar beets, apples, berries, etc., though in the case of the latter a higher degree of fertility is necessary in order to produce maximum crops, and the cost of production is again proportionally greater. I mention these points simply to emphasize the fact that these relations are worthy of careful consideration in determining our line of practice.

There are methods of practice which are entirely irrational, and contribute to the real losses, because the prices received for the constituents in the crops are actually less than the prices that would have to be paid for them, provided they were purchased in the open market in artificial forms, and these methods of practice are not confined to farmers whose lands of "inexhaustible fertility" have been given them by a generous government, but are followed by farmers who annually purchase

commercial fertilizers to supply the losses of fertility thus sustained.

For example, in selling clover hay at $8.00 per ton, which is the market price at this time, the nitrogen brings but 14 cents per pound, and the phosphoric acid and potash but 4.75 cents per pound—prices for the constituents lower than is on the average paid for them in artificial forms. In selling timothy hay at $12.00 per ton, on the other hand, the nitrogen is sold at the rate of 40 cents per pound, and the phosphoric acid and potash at 13 cents per pound. That is, twice as much is received for fertility in a product less valuable as a feed, and but slightly more expensive to produce. I do not forget that the clover possesses powers of acquiring food not possessed by the timothy, and hence in one sense is less exhaustive, but claim that that fact does not have a distinct bearing upon this point. The fact remains, that the loss of fertility due to artificial means by the sale of crops is largely measured by the knowledge of the producer concerning the relation between the price received and the fertility removed, and his intelligence in adjusting his methods so as to reduce to a minimum the actual loss. This is shown by his endeavor to sell the manufactured rather than the raw materials, that is, to so use his crude products as to lower the quantity of the constituents contained in those sold. The losses in this direction of our national capital stock are, however, not absolute, if the products are used at home, as more or less of the constituents contained in the crude products sold find their way back to the farm, either in the form of by-products of the mills, in sewage, in the manure from cities, and in various wastes, but when they are exported the loss is absolute, and the amounts so disposed of measure the rate at which we are losing our capital stock.

It is of interest in this connection to consider the losses of fertility in a few of our exports of both crude and manufactured farm products, which are rich in the fertility elements. In the last report of the statistician of the Department of Agriculture, it was shown that we exported in 1896, in round numbers, 400,-

ooo tons of oil meal, which included both linseed and cotton seed, and for which we received $8,000,000. It was purchased ostensibly on the basis of its value as a food, though this value was fixed by the export, and not by the home demand, but for the sum received we actually sold our fertility at ruling wholesale prices in this country for the same elements in artificial forms, viz.: 15 cents per pound for nitrogen, and 5 cents each for phosphoric acid and potash, we either lost our fertility absolutely, or we sold it at these prices and gave to the purchasers food equivalent in value to the $8,000,000 received. If we also look a little further in the same report, we find that we exported for the two years, 1893 and 1894, 6,000,000 tons of wheat and over 3,000,000 tons of flour; the flour represented in the wheat was a little more than was exported as flour, yet we received for the flour practically as much as for the wheat. Assuming that each ton of wheat contained as much fertility value as each ton of flour, though it contained slightly more nitrogen and less of phosphoric acid and potash, we received for the fertility constituents in the flour, nearly twice as much as for those contained in the wheat, for we retained from the wheat that is represented by the flour about 25 per cent of the nitrogen, 50 per cent of the phosphoric acid and 35 per cent of the potash. The money received was practically identical, yet in the exporting of flour we lost, in the first place, but little more than one-half as much of our fertility as in the wheat; in the second place, we retained in the refuse from it, bran and middlings, food more than equivalent in value to that of the fertility constituents; and, in the third place, we contributed to the building up of our own industries by the manufacture of the wheat into flour, no inconsiderable item, considered in all its relations. The total annual loss of fertility in our exports of farm products is necessarily very great, yet the kind of product exported should be considered in its relation to the losses of fertility—the subject is worthy of our serious consideration, though it may not seem to touch us very closely as individuals.

While I am aware that it is frequently wise to beware of the man with "figgers," especially if they are accompanied by the statement "that 'figgers' won't lie," I am tempted to do this here in order to more strongly emphasize this point of fertility losses, due to our exports of raw material, rather than of finished products.

My figures show that there were contained in the exports of the products mentioned the following amounts: In the cotton seed meal, 27,000,000 pounds of nitrogen, 12,000,000 pounds of phosphoric acid and 7,500,000 pounds of potash; in the linseed meal, 22,000,000 pounds of nitrogen, 7,000,000 pounds of phosphoric acid and 5,500,000 pounds of potash; in the wheat, 228,000,000 pounds of nitrogen, 108,000,000 pounds of phosphoric acid, and 78,000,000 pounds of potash; in the flour, 132,000,000 pounds of nitrogen, 33,000,000 pounds of phosphoric acid, and 42,000,000 pounds of potash—or a grand total for one year of 409,000,000 pounds of nitrogen, 160,000,000 pounds of phosphoric acid and 123,000,000 pounds of potash. This amount of nitrogen is equivalent to that contained in 1,300,000 tons of nitrate of soda, the phosphoric acid is equivalent to that contained in three-quarters of a million tons of acid phosphate, and the potash is equivalent to that contained in 123,000 tons of muriate of potash—quantities of nitrogen far exceeding the annual output of the nitrate mines of South America, of phosphoric acid equivalent to the amount of rock raised last year from the South Carolina deposits, and of potash more than an equivalent of the amounts contained in the fertilizers now annually used in the entire country. These are losses for which we have absolutely no return in the way of sewage, of manures, or of waste products of any sort. They are losses which if prevented would enable us to more cheaply produce those crops which contain the minimum of fertility, and for which we receive the maximum price, and not now grown because it costs us too much for fertilizer.

It is natural to infer that proper losses of fertility are confined to the removal of the constituents in the sale of farm pro-

ducts, and that those contained in the materials not sold and in the feeds used upon the farm, are again returned to the land. Theoretically this is correct, but the losses that do occur, particularly in the handling of manures, should not be overlooked. While it is impossible to even roughly estimate the waste or loss of fertility due to the improper making and handling of manures, some idea may be obtained when the enormous amounts produced and the sources of possible loss are considered. Resorting to "figgers" again, we find in the report of the statistician of the Department of Agriculture of 1896, that there are on farms and ranches in the United States in round numbers, 16,000,000 dairy cows, 31,500,000 oxen and other cattle, 16,500,000 horses and mules, 37,000,000 sheep and 41,500,000 swine. Assuming that the sheep and swine as manure producers are equivalent to 15,000,000 dairy cows, which is a fair assumption, we have a total equivalent to 78,000,000 grown animals. It has been demonstrated by careful experiments, that the amount of total excrement voided per year by a well fed animal of 1000 pounds live weight, reaches 10 tons, which would make a total of 780,000,000 tons for the entire number of animals. For sake of argument, we will assume that on the average the animals are in the field or on the ranges one-half of the time during the year, and that during this time all of the manure is returned to the land, but that during the other half of the year, they are in the yards or barns; on this basis, a total of 390,000,000 tons of manures would be produced in the barns and stables. A ton of the mixed excrement should contain under fairly good conditions of feeding, an average of 10 pounds of nitrogen, 8 pounds of phosphoric acid and 10 pounds of potash, or total nitrogen equivalent (in pounds) to ten times the number of tons of manure, total phosphoric acid equivalent (in pounds) to eight times the number of tons, and potash equivalent (in pounds) to ten times the number of tons—amounts so large as to be scarcely comprehended. There is hardly a man of us, however, but that appreciates the value of a ton of good manure. We all think that we could use it to good advantage, and we know that

if this enormous mass of waste material were properly used it would go a great way toward increasing our fertility, or in retarding the time of exhaustion, and it is quite proper to inquire if it is properly used. It has been demonstrated by experiments at the Cornell Experiment Station that fifty per cent of the total constituents in the manure is liable to be lost by illy regulated fermentation and by leaching, and further, that careful observations and experiments show that the conditions in the majority of barnyards are such as to encourage the maximum loss by these means ; it is morally certain that a large percentage of the con stituents contained in them are lost, they never reach the right place on the farm.

Assuming that the constituents lost reach fifty per cent, and that they are in the same proportion as they exist in the original manure, the loss would represent sufficient to furnish each state east of the Mississippi river with 1,560,000 tons of a mixed fertilizer containing 2½ per cent of nitrogen, 2 per cent of phosphoric acid, and 2½ per cent of potash, and which would cost each state nearly $20,000,000. The amount for each far exceeds the fertilizers now actually purchased in any state, although the amounts that are purchased constitute a serious tax upon the farmers, particularly in the eastern, middle and southern states. If but one-tenth of this waste could be prevented, and a very large part of it is practically preventable, and at a very slight expense, the total constituents possible to save for further use would be more than equivalent to the amounts now purchased in the form of commercial fertilizer, thus clearly demonstrating the serious drain upon our national resources, due to the lack of care in the handling of our manures.

I am well aware that to the average man statistical statements do not appeal very strongly, and to the average farmer or dairyman general statements are appreciated quite as little. My purpose, however, in pointing out our situation in this respect is to impress the fact that, while it is a matter that in one sense should appeal directly to the individual farmer, in another sense it reaches beyond him—it is also a national matter, and affects the future

prosperity of the nation as a whole, or, expressed in another way, the prosperity of an agricultural nation is measured by the intelligence exercised by the farmer in using these natural resources, viz: the constituents of the soil, and that, therefore, while it is a national matter, it is also an individual matter, because it is the individual that is responsible for the enormous aggregate loss of fertility in the manures mentioned.

What has preceded but feebly indicates the losses of our chief possession, "the fertility of our land", and yet there are those who are either so thoughtless, or so selfish, or so narrow-minded, as to urge the point "that we now have too much fertility for our own good, and that its waste is a Godsend; we produce altogether too much and, therefore, do not receive a fair price for our fertility and our labor." It is my mature judgment, that it was a great mistake on the part of our government to divide our best lands among corporations and foreigners, rather than to reserve it for the use of the descendants of those who, by their lofty patriotism and the spilling of their life blood made this free government possible, yet I do not believe that this is responsible for all of our woes. I am satisfied that the chief trouble is due not so much to an over-production *in toto*, as to lack of wisdom in the kind of production. It seems to me that an agricultural nation that spends an average of $390,000,000 annually for imported agricultural products, or over 50 per cent of the total expenditure for imports, and largely for food products that can be successfully grown in this country, rather bears me out in this belief. Why do we spend nearly $100,000,000, annually, for sugar? Why other millions for barley, eggs, potatoes, cabbage, onions, fruits and a host of other products, that we can grow quite as well ourselves? Is it because the German, the Englishman or the Frenchman has the advantage of us in that he is using free fertility obtained in our linseed meal, cotton seed meal, wheat bran, and so on? Perhaps this is the reason, for we have already observed that enormous quantities of nitrogen, phosphoric acid and potash are given away in these products, and we certainly get neither of these back in the sugar, for which we pay $100,000,000.

### III. HOW SHALL WE USE OUR FERTILITY?

In the discussion of the third point, I shall attempt to show how closely this matter applies to the individual farmer. The line of practice, whether it is the growing of the regular staples, wheat, corn, oats and hay, whether dairy farming, and the chief crops are Indian corn, clover, and grasses, whether it is special, and includes such crops as potatoes, tomatoes, and other vegetables, or whether it is the growing of fruits and berries, is subject to the same natural laws, though their effect may differ in degree. Assuming that farming on all these lines is practicable in one neighborhood, and under equal conditions as to character of soil, climate, and market, all should be equally interested in making available and in conserving the fertility. Good cultivation should be practiced, since this practice not only increases the utility of the potential fertility in our soils, but also improves their absorbent and retentive character, enabling them to hold for the plant the food thus made available. The lands should be constantly occupied with growing crops, because if left void of vegetation, the danger of natural loss of the constituents is very great, reaching a possible maximum in nitrogen of forty pounds per acre—more than enough to supply the demands of the average crop. Rotation of crops possessing different powers of acquiring food, and the seeding of catch crops are, therefore, arranged in such a way as to accomplish two distinct objects, first, to extend the period of profitable cropping, and second, to take advantage of the benificent provision of Nature, which enables an accumulation in the soil of nitrogen and of humus forming material. It is readily seen, therefore, that the principles thus far involved, particularly in the conservation of our fertility, or the prevention of natural losses, are common to all whatever the character of the crude products.

In the matter of artificial losses, and the principle involved in the sale of minimum amounts of fertility at maximum prices, specific rather than general principles apply. For ex-

ample, the old-line farmer can profitably sell a maximum of fertility for a minimum price, as he does when he sells grain, when his land is rich in all the elements of fertility, and when it has been purchased at a minimum price for the elements, and when the minimum of labor is required, while this practice cannot be followed with the same degree of profit on the poor and high-priced lands of the east, where fertilizers are required and labor is expensive.

The dairyman who converts his crude products into milk, cream, butter or cheese, and the stock raiser who converts them into beef, mutton or pork, all articles of relatively high price, and which contain a minimum of fertility elements, can increase their profits from the transaction largely in proportion as they recognize that in the feeding of stock those foods which are the richest in fertility elements are the ones usually necessary to economically improve their rations, and thus by virtue of better feeding, the losses of fertility are not only prevented, but great gains are made.

In a dairy of twenty-one cows, of which I have full records for the past year, the fertility sold in the milk included 849 pounds of nitrogen, 318 pounds of phosphoric acid and 248 pounds of potash, yet the fertility on the farm was not reduced because in the feeds necessary to purchase, in order to properly balance the rations and thus to feed economically, there were contained 857 pounds of nitrogen, 640 of phosphoric acid, and 214 of potash, in excess of that sold in the milk—amounts of fertility elements equivalent to over two and one-half tons of nitrate of soda and acid phosphate, and to over 400 pounds of muriate of potash.

The manures thus made possess in addition to their chemical and mechanical character, a biological function, and which recent discoveries have demonstrated to be very useful, contributing both directly and indirectly to the improvement of soils. It is to the interests of the dairyman and stock-raiser, and it is their line of practice more than any other, to which we must look for a reduction in the loss of constituents by the

exports of crude products. The farmers of the east should retain for their own own use that which is now given to foreign farmers, and with which they increase the fertility of their soils, and thus are able to successfully produce a crop which we now import, and for which we pay millions of dollars annually, though it contains not an atom of fertility.

These examples it seems to me fully illustrate the responsibility resting with the individual farmer, and contain suggestions which if followed will result in profit.

### IV. HOW SHALL IT BE INCREASED.

While I realize that a discussion of so broad a subject is somewhat tedious, it seems to me that the fourth point: "How to increase in fertility," should be touched upon. I wish to emphasize particularly the fact that although losses are constantly encountered in the directions mentioned, that there are also natural sources of gain both of potential and of active fertility. The gain in actual fertility elements is confined exclusively to nitrogen, and this gain, as already intimated, is chiefly due to the power which plants belonging to the leguminosae have of acquiring their nitrogen from "the inexhaustible stores of the atmosphere," as it is expressed by the Germans.

I shall not go into this matter in detail. Suffice it to say that under proper conditions (which are chiefly the presence in the soil of an abundance of the mineral elements, of the necessary bacterial life, and a reasonable deficiency of nitrogen), the gain of one crop from this source, is often sufficient to supply the needed nitrogen to three or four other crops, which depend entirely upon soil sources. The investigations of the Minnesota experiment station already quoted, bear directly upon this point, and show that in growing wheat and clover in rotation, the gain in nitrogen far exceeded that lost by the removal of the wheat crop. While the various crops of this order cannot be grown everywhere, one or more can be grown successfully in any state, and the farmer should use to the fullest extent this method of increasing his soil nitrogen. The gain in active fertility is due to the increase in the

availability of the dormant constituents, and is accomplished chiefly by cultivation; this gain, of course, is confined to soils naturally rich in the mineral constituents. The possibilities in this direction are nicely illustrated by recent work at the Cornell experiment station and reported in Bulletin No. 140 on "Potato Culture." The matter of artificial sources of gain, or the use of commercial fertilizers, is a broad subject in itself, and in this connection, I desire to make just one suggestion, viz.: that these consist exclusively of nitrogen, phosphoric acid and potash, and that the value of any product depends upon the quantity and quality of the one or more of these contained in it. This one thing if fully appreciated by the farmers would result in the saving of hundreds of thousands of dollars annually, now spent for mixing, bagging, handling and shipping absolutely worthless material.

I desire to say in conclusion, that in my judgment no one single factor will be more potent in correcting the present tendency towards wastefulness of our natural resources, and in enabling us to take advantage of both natural and artificial methods of increasing our fertility than education, not alone as applied to the farmer, but to all classes of our citizens, particularly as to the relation of soil fertility and its use in the right development and progress of all other interests. The disastrous results of certain legislation, affecting onr domain, now being felt in our whole country, are largely due to ignorance, not of the farmers, but of those who by virtue of improper education could not comprehend the relation of the conservation of our national capital in the fertility of our soil to the right development of other and allied industries, and thus misrepresented the true interests of the whole people. The safety of our future lies in education, and it behooves every one of us to encourage it in whatever form or direction it may take; it should begin in our public schools, rural and city alike, and be continued in the academy, the college and the university. I say we should welcome and encourage all efforts in this direction; I have no patience with those who regard it as "special instruction" to be taught only in special schools of the higher grades. Our right development as a nation demands a

knowledge of first principles, and these so far as now well established, should be broadly disseminated, and the responsibility rests alike upon the individual, the state and the nation.

Mr. Messer—You referred to the nitrogen floating off. What becomes of it?

Prof. Voorhees—Some goes off into the air, while some is carried into the sea.

Question—Does any of the latter escape into the atmosphere after it has got into the sea?

Prof. Voorhees—I should not expect that anything of this kind would occur.

Prof. Hills—We all regret that the exigencies of the railroad time-table will prevent Prof. Voorhees from remaining to take the major part of the interesting discussion which I am sure will follow his able paper. Some weeks ago he wrote me asking what phase of the plant food problem it would be well for him to discuss before this audience. I wrote him that the subject of fertilization had been quite fully covered in the old-fashioned way at the last two meetings of the Dairymen's Association, and that it seemed to me wise to strike out in some new line. This he has done, and I have been very glad to hear presented the idea, which is undoubtedly new to many of you, that the "Fertility of the Land" consists of something more than the presence in the soil of nitrogen, phosphoric acid and potash. I am certain that this address is well worth careful thought, and I urge the farmers of this state to earnestly study the same when it is in print.

As Prof. Voorhees remarked, the "fertility of the soil" (using the term in the broader sense), includes a due consideration of its water content, its temperature, of the character of the soil particles, etc., in short, the conditions accompanying the three deficient essential elements of plant food. He very properly called attention to the ever-present and real danger to us as individuals, and as a nation, of wasteful methods of the management of fertility, particularly as regards the nitrogen. This element is a "will-o'-the-wisp." One needs to exercise

many precautions and be thoroughly informed of the methods whereby it is lost from soil and manure heap, and the means of preventing the same, to be able to keep the soil in its best condition. Cultivation, drainage, continuous cropping, with proper restitution, the avoidance of leaving ground fallow, the use of catch-crops, particularly of the leguminous kind, all tend toward nitrogen saving.

The Professor called attention to the westward march of the fertilizer agent into regions formerly believed to possess inexhaustible fertility. This statement reminds me of what my old instructor, Prof. Stockbridge of the Massachusetts Agricultural College, taught when I was in his classes twenty years ago. He said that in his boyhood the farmers of Massachusetts were continually talking of the inexhaustible fertility of the Mohawk Valley (N. Y.). As he grew to manhood's estate the land of inexhaustible fertility had moved westward and was then in the Ohio Valley; and that now (1878) it was in the Mississippi Valley. Yet to-day we hear nothing of the talk of the inexhaustible fertility of the Mississippi Valley, but these fields are located in the Dakotas. Both science and practice have clearly shown that there is no such thing as inexhaustible fertility. The ordinary ill-judged methods of cropping without proper restitution will exhaust even the best of soils.

I am reminded here, also, of an experience I had some three or four winters ago in the course of my work with the State Board of Agriculture. We visited one town where all the conditions for good farming appeared to be abundant, yet everything was "down at the heel." Farming was at a low ebb, profits were none, and hard times and the tariff were being generally denounced. A few weeks later the Board was in a typical hill town of Vermont where conditions for farming were not as good, yet prosperity and cheerfulness reigned. The first town had for forty years been engaged in selling hay, the second town sold butter. The first town had for years been exporting nitrogen, phosphoric acid and potash; the second had exported carbon, hydrogen and oxygen. The first three ele-

ments named are derived from the soil and are the very essence of real estate; the last three are derived from the air and cost nothing. If one gets fair price for these soil derived elements, and, by judicious choice of crops or of rotation, or by proper practice, maintains the fertility of the farm, hay selling and the like may not be inadvisable, but cropping without restitution is the height of folly. Prof. Voorhees very properly called attention to the fact that crops are frequently sold at figures less than the market price of the fertilizing ingredients they contained, not to speak of the feeding values; also to the enormous losses from export of concentrated feeds, losses both of food and of fertilizer, materials which might far better be used at home, inasmuch as the prices obtained are not equal to their true values. In brief, it may be said that the fertility of the soil may best be used and most surely increased by (1) such cultivation as will tend to make more available constituents already present and favor proper soil conditions; (2) by as nearly constant occupation of the land by growing crops as our climate will permit, by proper rotation and by the use of catch-crops, particularly by such as clover and the legumes; (3) by the intelligent purchase of feeds with a view of "fertilizing by feeding;" (4) by the intelligent handling of home made manures and wise purchase of crude stock, or of mixed fertilizers; (5) by a proper appreciation of the use of the biological functions of the soil and of manures; and, last and most fundamental, (6) by thoroughly informing ourselves on all points in connection with this matter, and being armed with *education*, thus enabling us to better control natural forces to our needs.

President Smith—Can we by sub-soiling raise more clover?

Answer—I do not know much about sub-soiling. It is a practice that is not in vogue to any extent in the east. It is frequently very helpful on the arid soils of the west. I am likewise unable to answer the question regarding its effect upon the growth of the clover plant.

Mr. Sanford—I think we have a fertilizer in the state the natural product of the raising and feeding of our cattle. The

question arises how to use that in the best form so as to receive the greatest benefit from it. I believe if the farmer would take green manure, before it passes through any material change, and cart it on the ground and plough it under he would get nearly its full value. Where we undertake to rot it we are likely to lose the greater part of its value.

I think the usefulness of sub-soiling depends largely upon the character of the soil. If I had sand I would keep it under as much as I could. If I had clay loam or a mixture I would take up a little every year and plough the manure under. Manure is a heater, and by ploughing it under you get better growth than in any other way. I am speaking of hay, not grain.

Prof. Hills—I think the gentleman's idea is about right. The manure is seldom better for ordinary farm purposes than when voided. Rotting renders such constituents as remain more available, but there is usually much loss.

President Smith—Would you advise spreading manure upon a side hill when the ground is frozen?

Prof. Hills—Unless the land is quite steep the practice is fairly safe. If another's land lay at the bottom of a steep side hill, one might then hesitate.

Question—In regard to top-dressing; when manure is spread in the fall and winter, will not much of it wash off with the melting snow and rain, even if it is not very steep, and thereby entail loss?

Prof. Hills—If the land is retentive I think one would not need to fear any material loss.

A Member—I am in the same boat with our president as regards clover. I want to raise all I can, but I find it does not grow as it used to. I want to raise all the grain and all the clover I can on the same ground, consequently it is not laid down to grass as long as it was, and it seems to have become clover sick. The ground is well cultivated yet I find difficulty in getting clover as we formerly did where the ground lay down to grass a number of years. Is there any way this can be remedied?

Prof. Hills—I would like to ask these gentlemen whether or not their soils respond well to ashes?

President Smith—That is the line I am working on to try and raise more clover. In my experience, my soil is a heavy clay loam, and where I stock that, without ashes, I get only a slim catch of clover which will die out the first winter mostly. Where I put on ashes, it helps.

Next gentleman—I have not tried ashes much.

Prof. Hills—Ashes are useful in this connection largely because of the lime they contain, which neutralizes acidity and brings about a condition of alkalinity favorable to the growth of the bacteria upon the roots of clover which are so necessary to its success. I think that lime or ashes more often than any other one amendment aids in the solution of the problem of the growth of clover.

President Smith—I tried a little experiment this last July. I took an equal amount of value or cost of muriate of potash and leached ashes, putting on the same money cost on each strip, and I am going to watch that and see the result. This fall where I put the muriate of potash it was the poorest of any part of it. Whether or not it was owing to the lack of lime in the soil I do not know.

Prof. Hills—Clover needs potash, but even when lime alone is applied it usually gets its potash through the well-known power of lime to render more available the potash already in the soil.

A Member—Perhaps my experience may prove of benefit. I top-dress in the fall, and I find I can keep clover in by sowing the seed in the spring, and bushing over the ground where I top-dress in the fall. But it does not last very long; after cutting a few times the clover goes out. A gentleman at Waitsfield advanced this idea, that by cutting the clover early, the roots would remain in the soil longer and we might almost make it more lasting. Some of our people are going to try that.

A Member—I have had some experience with clover, lime and ashes, and I think lime is what the clover wants. I have sown ashes where I have stocked with clover, and also part ashes

and part lime. Where I sowed ashes and lime the clover was best. Down Essex way they stock down with rye and put on ashes, and the white clover grows very rank after about two years. Sowing lime and ashes there kills out the sorrel and the clover comes in. The lime seems to neutralize the acid of the soil.

## DEMANDS OF THE MARKET.

REMARKS BY ORRIN BENT, One of the Judges of Butter and Cheese.

*Mr. President:*

You ask me to say something on the demands of the market. Well, I will try and tell you a little about the demands of the Boston market as that is the only one on which I am posted.

I will tell you what the Boston market wants. They want the earth, that's all. If by chance you could get a perfect herd of cows, have them fed on sweet scented clover, milked by delicate milk maids and the butter made by a superb butter maker so it would score 100 points, they would find fault with it and want to know if when the weather was a little cooler or a little hotter, we could not get some butter that would score 105 or more.

A customer said to me one day, "Mr. Bent, there have been great changes in the mode of making butter since you have been in the business."

"Yes," I said, "there have, but the customers have changed as much or more." Years ago people used to put away their butter for winter the same as they do their coal; now it is a daily and weekly delivery for fear it won't be fresh. Why, the butter used to get a little oily before it was gone, but they used it day by day and got used to it. If we should send those good old ladies' daughters that are married and keeping house such butter to cook with, they would come down and read the riot act to us at once.

There have been many of those mothers and daughters who have traded in our place since I have been in Quincy Market and I came in 1868; those were the times of old-fashioned dairy butter. Some of it was very fine and would keep for many months

without ice. The men that made good dairy butter had nice, well made, clean tubs, well filled up with nice clean cloths over them, with just enough salt to make them look nice. I don't think I ever saw a good tub of butter with a dirty cloth, and let me say that the same thing applies to the creamery butter. Also we do not score off much on appearance. There is a great deal of difference in the selling of butter. Put it up neatly and tastily, fill your tubs well up and finish off the tops nicely and evenly. Wrap your prints up neatly.

And now about those prints. Our customers want them full weight. In these enlightened times, our customers have scales and they not only weigh the print, but the 4½ and 5 lb. boxes.

Now I want to say a word to you butter makers and cream producers. Don't you ever debauch that pure white milk so that you would be ashamed to look into the mild, clear eye of the cow. We can taste bad flavor in the butter sometimes. I know it would not have been there if she had been properly groomed and the milk properly looked after.

I have always liked the butter business and I have always tried to learn all I could about it and I have tried to do everything I had to do about it just as well as I could even to scoring.

Now my advice to anybody that has anything to do, from feeding and milking the cow, to making and shipping the butter, that if you don't take to it and don't like it, the quicker you get out of it the better it will be for all concerned. I tell you eternal vigilance is the price of good butter.

Now this is all I can think of at present. Should be happy to see any of you at our place of business and I will be glad to show you how we do business. Thanking you for you kind attention I will weary you no longer.

## THE DEMANDS OF THE MARKET.

ADDRESS BY MR. J. HARVEY WHITE, BOSTON.

*Mr. President, Ladies and Gentlemen:*

Before entering upon the discussion of the topic assigned me I would like to say word in relation to the scores which have just been read by Mr. Bent.

The butter exhibited at this meeting has not averaged to score quite as high as that in last year's competition. So far from being discreditable, it appears to me that a great deal of satisfaction may be found in the fact that the dairymen and creamerymen of Vermont during the weather of last week, with very unfavorable conditions, were able to produce an average lot of butter that fell less than a point short of the average score of last year.

The subject for this discussion is "The Demands of the Market." I wish that in this programme there might have been more time devoted to the subject of butter making, as it would have made clearer several points which I shall mention.

The most important element in the production of good butter is flavor. Not being a practical butter-maker I am hardly competent to discuss with you how to produce the best results, but being a seller of butter, it is quite possible to suggest the various effects that it would be profitable to eliminate.

Objectionable flavors are caused chiefly by objectionable germs or bacteria. To avoid these cream should of course be kept under the most cleanly conditions possible. I find that in most creameries and dairies in which the best results are obtained, the cream is ripened fast and as soon as possible after it

is obtained from the cow, rather than carried a long time at a low temperature before ripening it. Cream should not of course be ripened to too great an acidity, as that produces a sour flavor, an acid flavor, in the butter. Neither should cream be carried at a low temperature for too long a time as that produces a bitter flavor. The most common sources from which odors are absorbed are the barn, in which the milk is improperly allowed to to stand; the kitchen, which is often connected with the dairy room by an open door from which the odors of cooking find entrance; and uncleanly clothing, worn by persons when milking. In fact anything which will taint the atmosphere, such as a near by pig pen, silo, tobacco smoke, fertilizer or vegetables, will impart a flavor to butter that is offensive.

Finely flavored butter cannot by any possibility be made from cream that has been frozen. This is one of the greatest difficulties which creamery men have to meet at this season of the year in securing an article that will satisfy the best demands of the market. Another source of objectional flavors is the feed of the cows. Some feeds that are very excellent in themselves can be used so excessively as to give flavors that the trade does not desire. Ensilage is an excellent feed, and one which I think should be more used than it is, but it can be used excessively, particularly if it has not been well kept and cared for. Cotton-seed also, if fed excessively, will give a flavor to butter that is objectionable although it is one of the most excellent feeds on the market for the cow. When farmers feed turnips we frequently find that flavor in the butter. A musty flavor, noticable at times, is due to hay or other feeds that have become musty. Of course it is unnecessary to say that fruits and vegetables partly decayed do not produce good flavored butter. The period of lactation in the cow has a very considerable effect upon the flavor of butter, as all dairymen know. Cows that are fresh in milk produce better butter than those nearly dry. The one topic that is most frequently spoken of at dairy meetings is the introduction of filth into milk in the barn. I think that if this subject should be investigated carefully it would be found

that that source of objectionable flavors is not responsible for so large a proportion of the effect as is supposed. This flavor, to which we object, is more frequently absorbed as an odor than introduced as matter into the milk.

The proper care of utensils is an important matter. The washing of milk cans and other utensils in soap suds water is not sufficient. They should be scalded in boiling water and in creameries they should be handled with live steam. Another undesirable flavor found in butter is introduced by the use of poor salt. Salt that is not clean, or salt that has been placed in surroundings from which an odor can be absorbed should be rejected. Frequently it is stored in a haphazard way by storekeepers in the back room beside a kerosene tank, a bundle of codfish, a sack of onions, or near a stable and a flavor is absorbed by the salt which is given to the butter that is neither a fault of the salt nor of the buttermaker.

There are several suggestions, which may be looked upon as minor points, that have a bearing upon the production of good flavor. It is not necessary in this enlightened day to request that you do not allow your milk to stand in the barn one instant longer than is absolutely necessary. It is an undesirable thing to have the cows eating dusty hay at the time of milking, as they thereby saturate the air in their immediate vicinity with dust that carries germs which lodge in the milk, resulting in a poor flavor. A practice that I have noticed in some dairy barns is that of the farmer, while milking, placing his head against the side of the cow, thereby shaking into the milk pail the scales and small hairs from the body of the cow. In order that the flakes of loose skin, hair, dust and dirt, not mentioning the other sources of filth upon the cow, may not fall into the milk I have known dairymen to put a blanket or cloth under the cow during the process of milking, leaving a sufficient opening to make the milking convenient. The same result may be reached in a more practical manner if the flanks and under side of the cow be slightly rubbed with a damp cloth or sponge just previous to milking.

The best dairymen are those who care best for their cows. White-washing the stable helps to keep it free from germs, makes it more light and wholesome, helps to purify the air, and is important in many ways. An important point in the care of milk is to cool it as soon as possible after it comes from the cow. Germs and bacteria under favorable conditions double in number in about twenty minutes and they grow most rapidly at a temperature between 70 and 90. If the milk is at once cooled down to 60 or below a much pleasanter tasting milk and a vastly superior flavor in the butter will result.

Creameries are now experimenting considerably with pasteurized cream. Of course not being a practical butter-maker, my ideas must be largely obtained from observation of the results of the work of other people. Last November, in the New Hampshire meeting, where I acted as judge, in both of the creamery classes, tubs and prints, the butters to which I awarded the highest premiums, as I learned afterwards, were both made from cream that had been pasteurized, and the year before at the same meeting the butter which won the sweepstakes had been made from pasteurized cream. At this meeting the butter which scored highest in the print class, winning the sweepstakes, was made with a commercial starter, while that which scored highest in the tub class was made with a home starter. The principle was the same in each case. I am led to believe in good commercial cultures but I do not care to say very much on that point, because there are some cultures on the market that are not worthy of attention.

The next point upon the score card is grain. Here considerable latitude in scoring is allowed, owing to a difference of opinion that exists among buyers as to what constitutes a perfect article. There is one class of purchasers that desires a very dry, hard, waxy butter, that will stand up, as it is termed, that will spend well. Such butter has a great deal of style and character to it. Another class of people desires a butter that will spread easily upon a piece of bread, sinking into its pores, and melt quickly in the mouth. One is a hard butter and the other comparatively

soft. There is a legitimate demand for both textures. Therefore judges do not in scoring butter give quite the same scrutiny to that point that they used to when they had what was called a fixed standard of moisture and solidity that was used as a rule. The judges have to take into consideration that butter has its particular demands. If a piece of butter meets a recognized, legitimate demand, the butter is not scored off because of the particular ideas or preferences of the judge upon any particular point. For people who desire a particularly dry butter it can be obtained without overworking by absorbing the moisture from the top of the butter when it is on the worker instead of allowing it to drain off so far as it will. Some people wish as little moisture in their butter as can possibly be obtained. For these people it is necessary to do something more than to work out the moisture, for by so doing, in order to secure the required degree of dryness, the grain must necessarily become broken by overworking.

The next thing upon the score card is salt. Salt is one of the most vital elements in the manufacture of good butter. If one stands in the exhibition hall for a few moments and listens to the comments of the people as they pass in and out and sample the various packages of butter on exhibition there, it will be found that in more cases than otherwise the first remark is upon the amount of salt in the butter. One desires more and another less of salt, and there seems to be a prevailing opinion, at least among people who are not in the habit of competing, that there is a standard of salting to which a judge will adhere. Such is not the case. Butter that is salted an ounce and a half to the pound will be scored precisely the same as butter salted a quarter of an ounce to the pound, provided it is equally good. The demand is not for heavily salted butter. In some places from an ounce to an ounce and a half of salt to the pound is demanded, while the average salting is from three-quarters to an ounce to the pound. There is an increasing demand for butter that does not contain over half an ounce to the pound. Therefore the judges have not paid any attention to the amount of salt in the butter. Butter should be so salted that when it has reached the market or the

consumer the salt should be fully dissolved, and not appear when in the mouth to contain any gritty grains whatever. A fine salt of course dissolves much more quickly than a coarse salt, and for people who are placing their butter upon a market where it is consumed very fresh from the churn it seems to me that they should aim especially to secure a quickly dissolving salt. There is another point that I think is vital, judging from the fact that I have been more times asked concerning it than in relation to any other feature of salting, namely, whether it is desirable to use a fine or somewhat coarse salt in the manufacture of butter, and my answer has always been in favor of fine salt, not only for the reason that it is more soluble, but because of the fact that in working the butter it is much less liable to damage the texture and grain. Let us suppose that two substances, one a fine powder-like frosting sugar and the other coarse sand, be worked into butter in the same manner as salt. Which of the two substances would grind up and break the grain of the butter to the greatest extent? Of course it is easily seen that the sand or coarse grained substance would damage the texture to a much greater extent than the fine powder. On that account I am inclined to favor the fine salt. That does not indicate any one brand as against another as nearly all manufacturers produce both coarse and fine grained salt.

Color is an important matter. Here again the judges are allowing much more latitude than formerly. We have seen a great deal in the papers of late to the effect that butter made in this country and shipped to England suffers because of its high color. Butter made in Ireland, Denmark, Sweden, and other countries upon the continent, is slightly colored, if at all. There has been a great tendency, as a result, to lighten the color of butter, although it may be safely said that the demand in our own market has not changed. The standard is still June grass color, but there being a demand, for export chiefly, for much lighter colored butter, it will be found that butter that a year or two ago would have been scored off a point or two on color, has been thought by the judges at this meeting not at fault, because there is a legitimate

and recognized demand for light colored butter. Therefore that point has ceased to be of quite the same importance as previously. The most important feature of butter in the point of color is what is called mottles. How these mottles are produced I cannot tell you in every instance. They may be produced in a great many different ways, but there is a method of obliterating the mottles after they have been produced that is practical for every butter maker, and that is to give the butter another working, thus mixing the mottles with the darker butter until all becomes one shade. That of course injures the grain to some extent. It is simply the last resort to which a person is driven in an unfortunate handling of his butter ; but the breaking of the grain necessary to remove the mottles is not nearly so great a damage to the butter as the mottles.

The last item upon the score card is package and packing. Mr. Bent has suggested to you the importance of an attractive package. I would like to say amen and amen to that point in his remarks, as indeed I could to every one. While the style of package is not a tangible thing that can be removed and sold by itself, yet it plays a very important part in the price that is obtained for the goods that are to be marketed. More especially is this true of print butter. Frequently I have had to make a discount of three or four cents a pound upon print butter because it has been received in a disorded condition due often to being heated in transit, or thrown about in the car and jammed out of shape. The only reason why print butter sells for a little higher price than tub butter is because it is more attractive. When that attractiveness is destroyed it becomes less desirable than tub butter. The demand in the Boston market is for a half pound print, each one being packed in parchment paper. There is a growing demand for the parchment brick shaped boxes, holding five pounds of butter. The round five pound box continues to be the more popular of the two, but as times goes on I think we will see the round box supplanted by the square box as tubs have supplanted all the firkins, of which the younger persons here have no recollection. I would

like to suggest to the butter makers of Vermont that they line their tubs with parchment paper. The west is leading the east in meeting the demands as fast as they appear. I think it may be said to be a characteristic of Vermont that she waits until a demand is fully established instead of going ahead and creating a demand and gaining the advantage of being in the lead. I have been told by good authority that last year about 90 per cent of all the butter from the west shipped into New York was shipped in parchment lined tubs. I do not know of a creamery in Vermont that is lining its tubs with parchment paper. The advantage derived from this lining is considerable. It in part prevents any taste from the wood; in warm weather the butter will not stick to the sides of the tub, and can be turned out as though it were in a mold, and it prevents moisture from evaporating and running out of the butter.

There is one other small point, trifling perhaps in its importance to you, but of some consequence to us at the other end of the line where we handle the butter, that I would like to mention. That is the use of tin rather than wire fastenings for the tubs. Wire fastenings become corroded and brittle and after standing for a short time they are apt to break when opening the tub with a hatchet and become really dangerous for the boys in the store who have to handle the tubs for shipment.

A suggestion or two in relation to shipping and I am through. Your butter should be sent regularly to the same place. It is not desirable, either for the creamery man or for the dairyman to be continually changing their dealers. If a commission man is at all worthy of your patronage he will be willing to build up your trade for your particular brand of butter, and every time you change your agent you make it necessary for some one to begin over again and build up a reputation for your brand. Another point which I would like to mention, somewhat in the same line, is that it is undesirable for creameries to ship their goods to more than one commission house or selling agent in the same market. If the same article can be obtained in two stores, buyers will go first to one and then to the other

to see where it can be bought the cheapest. Do not cause your butter to compete against itself by placing it in the hands of two or three different firms, as you thereby in fact undersell yourself although perhaps you are unaware of it. If, however, as in some creameries, there are special reasons why it is desirable to go to two or more houses on the same market, and you should continue to do so, I would suggest that the butter be sent under two different creamery names, thereby you can avoid the competion of trade mark against trade mark and each man can work up a reputation in his own peculiar way without infringing upon the trade of the other merchant who handles it.

Vermont is at the head of the butter producing states in quality, but the west are going ahead of us here in the east in new ideas and new appliances, and I would urge you to give the most careful scrutiny to the new ideas that are being developed by the supply houses for the production of butter, or the more easy production of butter, of the present quality. Do not let Vermont become enveloped in the cloud of old fogyism, but let her take the front rank in methods as well as in products.

Question—How is cream pasteurized? What is the effect upon it?

Mr. White—I would refer that question to Prof. Hills. I hope the audience does not understand me to say that it is necessary to pasteurize cream in order to secure premium butter, but simply that pasteurized butter has frequently won premiums.

Prof. Hills—The pasteurization process consists of the rapid heating of a fluid to 155 to 160° F., holding it there for about 20 minutes, and the rapid cooling thereof to about 40° F., all contact with air or other contamination being avoided. If properly conducted about 99 per cent of the entire germ life is killed. After this is done the cream may be artificially ripened with natural or artificial cultures with greater likelihood of good results.

A Member—Years ago we would call this process scalding milk, but now they call it by these new names.

Prof. Hills—There is a vast difference between the scalding and the pasteurization of milk. By the former process milk is heated nearly or quite to the boiling point and is usually cooled slowly. It has a cooked taste, its digestibility is seriously affected, a good many bacteria get into the milk after heating and its keeping qualities are but slightly enhanced. Pasteurized milk has no cooked taste. is as digestible as new milk, bacteria are almost entirely killed out and are entirely kept out, and its keeping qualities are greatly improved.

Question—How are moldy tubs best prevented?

Mr. Bent—A moldy package is so severe a handicap in selling that it is almost impossible to get a decent price, even if the butter is of extra quality. Mold is a growth which is closely allied to bacteria. They are usually caused either by impurities or moisture and their growth is favored by certain atmospheric conditions. They cannot grow where there is no moisture. The best way to obviate this trouble is to secure conditions under which mold cannot live. Cleanliness is of course an essential thing, but I think the main point is to keep your packages away from the dampness.

Mr. Tinkham—Is not insufficient working the main, perhaps the only cause of mottled butter?

Mr. White—I should like to have this matter freely discussed. Insufficient working is one of the most frequent, indeed the usual, sources of mottle.

Mr. Tinkham—What are the others?

Mr. White—If the cream when placed in a churn contains chunks of semi-solid matter, if it is not carefully churned, and even then if scraped down would churn out into butter, and consequently you make a mat into which the butter coloring would not penetrate, that would produce a great white chunk of mottle.

Question—If that was not churned would it still remain cream?

Mr. White—It would if as hard as it sometimes is.

Question—In that case would it not wash out with the water?

Mr. White—I have seen cream so solidified into masses as to cause it to stay in a mass in the center of the butter.

The gentleman has suggested to my mind the importance of washing butter with the greatest of care. The old-fashioned way, fortunately in the main abandoned, was to work it out. It is easy, however, to wash granular butter and to attain better results. If the butter-milk is allowed to remain in the butter it will produce a bad flavor at the start, and the butter will become rancid or strong much more quickly than if good sweet brine is incorporated in it.

President Smith—We have gentlemen here whose butter took the premium and I would like to have them make statements as to how they handle their cream and butter.

Mr. Drummond, of Highgate—Nineteen new milch cows: one feed of ensilage, one of hay, one of peas and oats, green; oats and cornmeal for grain feed; separator cream; ripened along side of the stove; no commercial starter used; churned in twenty-four hours at 62° F., slightly acid; worked on an old-fashioned home-made worker.

President Smith—Mr. White suggests that the gentleman was not cooking bacon while that cream was ripening beside the stove.

Mr. Roberts—Six new milch cows, all young; dry corn-fodder, and rowen, cornmeal, bran and gluten; separator cream, cooled, mixed, ripened one or two days, to suit my ideas, at 64° to 70°; churned twice a week at 64°; swing churn. Cows are Jerseys making 329 pounds apiece at a cost of $55 to $60 per year apiece. I have never tested the buttermilk.

Mr. White—Regarding the cost of the butter; 329 pounds of butter per year costing $55 would make the average cost of butter almost seventeen cents per pound; 329 pounds of butter costing $60 a year, would make the average cost of butter eighteen cents per pound and a fraction over.

Mr. Tinkham—Should not the by-products be figured in?

Mr. White—Let that go into the profits.

Mr. Smith of Fletcher—Fifty cows, 6 fresh remainder spring cows; 2 days' milk, separator cream; cream from first day cooled to 40°, that from second day not cooled, thus bringing entire mass to 62°; held one day further during which time it dropped to 56°, at which temperature it was churned, washed in granular form in two waters; worked 7½ minutes in Fargo worker; salted ¾ ounce to the pound. A part of the churning was worked but six minutes, the remainder was worked a second time for one and a half minutes. The former lot was slightly mottled.

In regard to salting; does butter require more salt in the winter to bring out the flavor than in the summer? I ask this question because the people who are having my butter wrote me a few days ago that they thought a little more salt would improve the flavor.

Mr. Bent—I doubt if salt would take the place of flavor.

Mr. Smith—The butter sent them was salted five-sixths of an ounce to the pound.

A Member—Does salt effect the flavor of the butter at all?

Mr. White—I do not know as I really enjoy discussing that question, but since it has been asked I will say this: As a result of 30 or 40 experimental churnings made by creamery men, the butter being sent me for scoring, I think there is not the slightest doubt of it. I am not here to advertise any particular salt; it would hardly be proper for me to do so. But I have seen different salts as they have been compared in careful tests made from the same churning, and I could recognize the different salts. I have done this so many times that I could name them because of their effects upon the flavor. So I think there is no doubt about salt flavoring the butter.

Mr. Tinkham—Does it make any difference whether there is an ounce or half an ounce of salt to the pound; that is, will the extra or additional salt have anything to do with bringing out the flavor?

Wr. White—Salt covers up flavors. If you have got a fine article of butter salt it as little as your customers will stand, but not differently from their wishes. If they want two ounces, put it in; but if you have a nice, delicate flavor do not hide it. But if, in the winter time, the butter lacks the flavor, a little more salt will give a little of the liveliness that is called for. Mr· Smith's experience is that of probably half the dairymen in this state at this season of the year. There is flavor in June butter which it is impossible to produce in the winter time. They miss it, want to bring it up, and so call for a little more seasoning.

Mrs. Nelson—I would like to ask about one exhibit. It was marked "mottled" and also marked "grain hurt by overworking."

Mr. Bent—Rather hard work to answer that question. I think perhaps it was worked before salting.

Mrs. Nelson—It was mottled very badly.

## REPORT OF BUTTER AND CHEESE EXHIBIT.

### BUTTER.

| | |
|---|---|
| Whole number of entries | 85 |
| Lowest score | 86 |
| Highest score | 98 |
| Average | 92½ |

Premiums awarded as follows:

#### CLASS 1, DAIRY TUB.

| | | Prize. | Score. |
|---|---|---|---|
| 1st. | J. B. Dimon, Highgate | $10 00 | 96½ |
| 2nd. | C. F. Smith, Morrisville | 6 00 | 96 |
| 3rd. | C. H. Cobb, Westford | 4 00 | 95¾ |

#### CLASS 2, DAIRY BOX.

| | | | |
|---|---|---|---|
| 1st. | D. W. Roberts, No. Pomfret | $10 00 | 96½ |
| 2nd. | P. W. Strong, No. Pomfret | 6 00 | 95½ |
| 3rd. | L. M. Cameron, Middlesex | 4 00 | 93½ |

#### CLASS 3, DAIRY PRINTS.

| | | | |
|---|---|---|---|
| 1st. | G. C. Bean, Coventry | $10 00 | 97¼ |
| 2nd. | E. S. Martin, Williamstown | 6 00 | 97 |
| 3rd. | Nathan H. Ricker, Ryegate | 4 00 | 96¾ |

#### CLASS 4, CREAMERY TUB.

| | | | |
|---|---|---|---|
| 1st. | E. E. Symes, Ryegate | $10 00 | 98 |
| 2nd. | T. H. Bickford, Bradford | 6 00 | 97 |
| 3rd. | Wm. V. Beach, Charlotte | 4 00 | 96½ |

CLASS 5, CREAMERY PRINTS.

| | | | |
|---|---|---|---|
| 1st. | F. L. Smith, Fletcher | $10 00 | 97¾ |
| 2nd | R. F. Jaynes, Ryegate | 6 00 | 97¼ |
| 3rd. | Carpenter Bros., W. Waterford | 4 00 | 95 |

Vt. Dairymen's Gold Medal Prize, E. E. Symes, Ryegate.

Creamery Sweepstakes, E. E. Symes, Ryegate .......... $2.00

Grand Sweepstakes, E. E. Symes, Ryegate ............. 5.00

Best displayed package, R. F. Jaynes, Ryegate .......... 3.00

Baldwin Refrigerator Prize, E. E. Symes, Ryegate, highest score in tubs.

Two gals. Wells & Richardson Butter Color, E. E. Symes, Ryegate, highest score in creamery butter.

One gal. W., R. & Co.'s Butter Color, G. C. Bean, Coventry, highest score in dairy butter.

Vt. Farm Machine Co., Cooley Creamer Prizes:

1st. W. I. Clapp, Barre, No. 96¾ ................ $15.00

2nd. George Davis, E. Montpelier, No. 96¼ ....... 10.00

3rd. P. W. Strong, N. Pomfret, No. 95½ ......... 5.00

Vt. Farm Machine Co., U. S. Separator Prizes:

1st. E. E. Symes, Ryegate, No. 98 ............... 15.00

2nd. F. L. Smith, Fletcher, No. 97¾ ............. 10.00

3rd. R. F. Jaynes, Ryegate, No. 97¼ ............ 5.00

$10.00 each was paid to the above exhibitors, their butter scoring first, second and third in the whole exhibition.

Worcester Salt Prizes. Butter salted with Worcester Salt:

BEST CREAMERY BUTTER.

1st. E. E. Symes, Ryegate, gold watch valued at .. $25.00

2nd. F. L. Smith, Fletcher, gold watch valued at .. 15.00

BEST DAIRY BUTTER.

1st. G. C. Bean, Coventry, gold watch valued at .. 25.00

2nd. E. S. Martin, Williamstown, gold watch valued at ...................................... 15.00

$25.00 in gold to butter winning sweepstakes, and gold medal, E. E. Symes, Ryegate.

Mirror and Farmer Prize: One copy of Mirror and Farmer to each and every prize winner in both butter and cheese classes.

Vermont Farmer's Advocate Prize:

BEST DAIRY BUTTER.

One copy one year, G. C. Bean, Coventry.

BEST CREAMERY BUTTER.

One copy one year, E. E. Symes, Ryegate.

CHEESE SCORING HIGHEST.

One copy one year, J. C. Oliver, Charleston.

Cultivator and Country Gentleman Prizes: One copy one year to owner package butter scoring highest, E. E. Symes, Ryegate.

One copy one year to owner of cheese scoring highest, J. C. Oliver, Charleston.

PRO RATA CLASS, PAID $1.00 EACH.

| | |
|---|---|
| G. H. Soule, Fairfield | 91 |
| S. Hoar, Barnard | 90 |
| E. E. Sherburne, No. Pomfret | 92 |
| Samuel H. Warren, No. Pomfret | 91 |
| J. C. Sherburne, No. Pomfret | 90 |
| D. A. Kneeland, Waitsfield | 90 |
| H. B. Leonard, No. Pomfret | 90 |
| F. L. Davis, No. Pomfret | 90½ |
| C. P. Chase, Proctorsville | 91 |
| J. R. Corliss, St. Albans Bay | 92 |
| O. Clark, E. Montpelier | 92 |
| H. S. Eldred, Sheldon, | 90 |
| C. D. Smead, West Brookfield | 91 |
| C. E. Martin, Rochester | 90 |
| Sumner Sherburne, So. Pomfret | 92 |
| N. Bigelow, Stowe | 92 |
| J. B. Candon, Chittenden | 95½ |
| Chas. F. Stafford, Chippenhook | 96½ |

| | |
|---|---|
| G. H. Terrill, Morrisville | 93½ |
| J. R. Miller, Ryegate | 95½ |
| Mrs. C. J. Nelson, Ryegate | 96½ |
| A. P. Royce, Swanton | 93½ |
| C. A. Choate, W. Barnet | 96¼ |
| Geo. Davis, E. Montpelier | 96¼ |
| Marshfield Creamery | 95 |
| J. G. Turnbull, Barton Landing | 94½ |
| C. A. Wheeler, W. Charleston | 92 |
| Wm. V. Beach, Charlotte | 96½ |
| T. W. Towers, Richmond | 91 |
| J. J. Jackson, East Montpelier | 93 |
| E. C. Hillis, No. Montpelier | 94 |
| East Ryegate Creamery | 93½ |
| Wells River Creamery | 90 |
| Sharon Creamery | 92 |
| Strafford Creamery | 94 |
| T. E. Donahue, Hinesburgh | 92 |
| D. G. Donohue, Charlotte | 91½ |
| Ed. Bissonette, Addison | 93¼ |
| E. R. Towne, Waterbury | 94¾ |
| B. Hawley, Williamstown | 95¾ |
| Brattleboro Creamery | 92¾ |
| B. A Hatt, So. Ryegate | 93½ |
| Woodstock Creamery | 93¾ |
| E. F. Smith, Plainfield | 92½ |
| Randolph Co-operative Creamery | 94½ |
| Springfield Creamery | 94 |

## CHEESE EXHIBIT.

| | |
|---|---|
| Whole No. Entries | 20 |
| Lowest Score | 85 points |
| Highest Score | 98 points |
| Average | 93½ points |

Premiums awarded as follows:

CLASS A. (DAIRY PLAIN).

| | | | |
|---|---|---|---|
| 1st. | J. C. Oliver, Charleston | $10 00 | 98 |
| 2d. | J. H. Riley, Sheldon | 6 00 | 97 |
| 3d. | A. Messer, Rochester | 4 00 | 95 |

CLASS B. (DAIRY SAGE).

| | | | |
|---|---|---|---|
| 1st. | J. C. Oliver, Charleston | $10 00 | 93 |
| 2d. | J. H. Riley, Sheldon | 6 00 | 92½ |
| 3d. | Clark Simonds, Northfield | 4 00 | 92 |

CLASS C. (FACTORY PLAIN).

| | | | |
|---|---|---|---|
| 1st. | H. W. Rice, Westford | $10 00 | 97 |
| 2d. | Ed. Bissonette, Addison | 6 00 | 96 |
| 3d. | P. McDonough, Hinesburg | 4 00 | 95½ |

CLASS D. (FACTORY SAGE).

| | | | |
|---|---|---|---|
| 1st. | T. B. Harriott, North Georgia | $10 00 | 96½ |
| 2d. | Ed. Bissonette, Addison | 6 00 | 96 |
| 3d. | H. L. Warner, Shoreham | 4 00 | 95 |

Grand Sweepstakes, J. C. Oliver, Charleston ........................ 98 points

## REPORT OF THE LEGISLATIVE COMMITTEE OF VERMONT DAIRYMEN'S ASSOCIATION.

BY HON. V. I. SPEAR, CHAIRMAN.

The report of your legislative committee has pretty much been read from the platform by Prof. Hills, who is a member of this committee, although I think some one told me I was named as chairman of the committee at our last meeting, and it is my duty here simply to say to you that your committee, during the past year, have enjoyed all the honors of the position and all the emoluments of the office, and have not done any particular work. They have not done the work because there seemed to be nothing definite that could be done during this past year. The committee, as it was appointed, of course, was in contemplation of securing some sort of legislation that would be of aid in helping harmonize the creameries and the patrons of the state, and as the Legislature of Vermont has not been in session since last January we have not had any fair chance at it, so there has not been any opportunity to accomplish anything during this time, except to observe and note in our individual experiences instances that seem to be calling for some action along this line. I believe it is fully as much for the interest of the creamery here in Vermont to adopt some sort of system for this work as it is for the patrons. As it has been well stated by Prof. Hills, probably the main part of the trouble we are getting there is through misunderstanding or through ignorance on one side or the other. Some of it may be through dishonesty. I do not know. But whatever the reason is it is clearly of more importance to the manager of the creamery to satisfy his patrons that they are having fair usage than it is for any one person to become satisfied that he is getting a fair division on his individual milk.

So I believe that we will secure some system which will prove satisfactory to both the creamery management and the patron. There is dissatisfaction everywhere in connection with this subject and we hardly strike a town but has its trouble. There is a feeling that dishonesty or ignorance is taking something from the patrons. This dissatifaction tends to the introduction of more creameries in many towns than can be supported, and creates an unprofitable rivalry of the creameries that cover the same territory. There is a great temptation, of course, under all these conditions, for creameries to try and make a good showing in order to secure patrons. So it seems to me at this time that there is even greater necessity for something to be done than there has been in the past.

While I am upon the floor, Mr. President, there is another matter that I wish to call up again at this session of the Vermont Dairymen's Association. It is a matter very similar to what came before you last winter. I think the bill is a little differently worded, but it has for its object the same purpose. It is a bill that has been sent to us by Major Alvord, chief the dairy division at Washington, asking that Vermont dairymen and sugar makers should endorse it because he believes that it will be much to our advantage both as a state and as individuals to do so. It provides generally that each state may adopt a trade mark for the goods produced within its borders, whether butter, cheese, or what not; anything grown within the limits of any state shall be entitled to use this trade mark, which shall be registered in the United States department and shall be a protection to the goods therein produced. We heard complaint in Vermont that butter, branded with the name Vermont, and being sold as Vermont butter, was not produced here; and some have found that there was sugar sold in the United States that was marked Vermont maple sugar and was really something else.

(At the suggestion of Mr. Messer, Mr. Spear read from the bill above referred to, all of which appears below:

## SENATE BILL NO. 3354

To Protect and Promote Foreign and Interstate Commerce.

*Be it enacted, by the Senate and House of Representatives of the United States of America, in Congress assembled:*

SECTION 1. That in order to prevent the false branding or other marking of goods, wares or merchandise, the product of any state or territory of the United States or of the District of Columbia, which are, or are intended to become, articles of foreign or interstate commerce, the governor of any such state or territory, and the commissioners of the District of Columbia are hereby authorized and empowered to adopt a public trade mark, each for his or their respective state, territory or the district aforesaid, and file a description and illustration of the same in the Treasury Department of the United States.

SEC. 2. That upon the receipt of any description and illustration of a trade mark, as provided in the preceding section, and upon the payment of a fee of twenty-five dollars, the Secretary of the Treasury shall register the same, and a certificate of such registration fully describing such trade mark shall be issued in the name of the United States of America, under the seal of the Treasury Department, and signed by the Secretary of the Treasury, and a full record thereof be made and kept in books for that purpose. Copies of any such trade mark and of the description accompanying the same and of the certificate of registry, when duly authenticated by the Secretary or any Assistant Secretary of the Treasury, shall be received in evidence in all courts and by all officers of the United States, and shall be conclusive proof of the adoption and registration of such trade mark.

SEC. 3. That every such trade mark shall be used only under and in accordance with such rules, regulations and retrictions as may be provided by or according to the laws of the state, territory or district adopting and filing the same, and upon goods, wares and merchandise produced, grown or manufactured therein and upon packages and wrappers containing the same.

SEC. 4. That every person, who, contrary to the provisions of this act or to the laws, rules, regulations and restrictions of any state or territory or of the district aforesaid, affixes the registered trade mark of such state, territory or district, or causes or procures the same to be affixed, or any colorable imitation thereof calculated to deceive the public, to any goods, wares or merchandise, which are, or are intended for sale, consumption shipment, or use without and beyond the boundaries of such state, territory or district, or to any package or wrapper containing the same, shall be deemed guilty of a misdemeanor, and on conviction thereof, be punished by a fine not exceeding one thousand dollars or imprisonment for not more than two years, or by both such fine and imprisonment in the discretion of the court.

SEC. 5. That every person who shall knowingly deal in or sell or keep or offer for sale, or cause or procure the sale of any goods, wares or merchandise, in order that the same may become, or after they have become. subjects of foreign or interstate commerce, to which, or to the package or wrapper containing the same, there is fraudulently affixed any public trade mark as provided in this act or any colorable imitation thereof calculated to deceive the public, shall be deemed guilty of a misdemeanor and on conviction thereof shall be punished as provided in section four (4) of this act.

SEC. 6. That every person who fraudulently fills, or causes or procures to be fraudulently filled any package, or fraudulently uses or causes or procures to be used, any wrapper, to which is affixed any public trade mark registered pursuant to the provisions of this act, or any colorable imitation thereof calculated to deceive the public, with any goods, wares of merchandise, with intent to deceive or mislead any purchaser or user of the same, as to their true character, origin or source, shall, if said goods, wares or merchandise have become, or are intended to become, subjects of foreign or interstate commerce, be deemed guily of a misdemeanor and on conviction thereof shall be punished as provided in section four (4) of this act.

SEC. 7. That if any person shall brand, mark, stamp, stencil, label name or describe any goods, wares or merchandise, or any package or wrapper containing the same, which have or may become subjects of foreign or interstate commerce, in such manner as may be calculated to deceive or mislead any purchaser or user of the same as to the true character of such goods, wares or merchandise, or as to the place where they were grown, produced or manufactured, or shall cause or procure the same to be done by others, or if any person for himself or as agent or factor for another, or as a member of any co-partnership, or as a manager, superintendent, agent or representative of any corporation shall have in his possession or under his control any goods, wares or merchandise, which he knows or has good reason to believe bear any public trade mark, or any brand, mark, stamp, stencil, label, name or description, in contravention of the provisions of this act, he is guilty of a misdemeanor and upon conviction thereof shall be punished as provided in section four (4) of this act.

Mr. Sanford made a motion that the report of the legislative committee be accepted, and the same was carried by vote.

## REPORT OF COMMITTEE ON RESOLUTIONS.

*Resolved*, That we desire to express the deep sense of the loss this association has sustained, in the death of Mr. F. S. Collins, who, during his long years of membership was ever active, faithful and zealous in the discharge of his duties and who was one of the few who put into active practice the results of the experience gained at our meetings, by which he grew in knowledge and wisdom, and became not only a better farmer but a more exemplary citizen, and who died, as he lived, an honest and honorable man, whose death is a loss, not only to this association but to the entire community in which he lived.

*Resolved*, That a copy of this resolution by sent to the family of our deceased brother, and given to the press for publication.

*Resolved*, That we fully believe in progress ; and we shall not be satisfied until we have brought the dairy interests of Vermont up to the highest standard of excellence, so that we may rank A-1 in this industry, as a state, in the manufacture of both butter and cheese.

*Resolved*, That we have an abiding faith in the intelligence of the farmers and dairymen of this state, and that, as a body, they desire to conduct their business with judgment, and are entitled to all legitimate legislative protection, and we urge the desirability and necessity of the enactment of the laws suggested by the legislative committee.

*Resolved*; That while we feel that we are under deep obligations to those who impart instruction and the results of their experience and investigations to us at these meetings, we should remember that unless we make some practical use of the knowledge gained by means of the addresses and discussions, we shall not profit by them as we should, and we consider it the duty of every farmer and dairyman in the state to resolve to adopt the new and better methods here suggested, as far as he can consistently with his circumstances, to the end that the farming community of this state may enter upon an era of greater prosperity in the immediate future.

*Resolved*, That we favor the enactment of a just and equitable law against the present unequal system of double taxation, which has been so long a burden to the people of this state.

*Resolved*, That our thanks are due and hereby tendered to the good citizens of the city of St. Albans for their kindness and hospitality, and espe-

cially for their liberality in providing this beautiful hall for our meetings, and for the great expense incurred by them in preparing and fitting up the rooms for exhibits and in providing facilities and conveniences for our meetings. We also desire to thank the railroads and hotels for reduced rates; the press for favorable notices and excellent reports; the Franklin County Creamery Association for the handsome badges given to the members of the association; to Parker's orchestra for delightful music; to Miss Tobin for her reading, and every one who has contributed to our comfort and enjoyment, and the success of this meeting.

M. W. CLARK,
G. H. TERRILL,
B. S. BARRETT,
J. K. CURTIS,
F. L. DAVIS.

The report of the committee on resolutions was accepted and adopted by a unanimous vote.

The following resolutions were then offered by Hon. J. O. Sanford, which were also accepted and adopted, viz.:

*Resolved*, By the Vermont Dairymen's Association and the Vermont Maple Sugar Makers' Association in joint meeting assembled, that our members in Congress be instructed to use their endeavors and influence to secure the passage of the pending bill No. 3354 providing for a state trade mark to protect the products of the several states in interstate commerce.

*Resolved*, That the Legislative Committee of the Vermont Dairymen's Association be requested to consider the advisability of securing a state law for the prevention of adulteration of cattle foods, and that they be empowered to act with the Legislature to this end.

Resolution adopted.

## REPORT OF SECRETARY AND TREASURER OF VERMONT DAIRYMEN'S ASSOCIATION.

From December 1, 1896 to December 1, 1897.

| | |
|---|---|
| Received State appropriation | $1,000 00 |
| Received for membership | 121 00 |
| Received for advertising | 241 00 |
| Total receipts | $1,362 00 |

### BILLS PAID AS APPROVED BY THE PRESIDENT AND SECRETARY.

| | |
|---|---|
| Charles D. Woods | $ 50 00 |
| J. W. Sanborn | 37 50 |
| Anna Barrows | 34 00 |
| E. L. Hildreth & Co | 1 50 |
| G. W. Pierce | 175 00 |
| Mrs. A. C. Ware | 8 25 |
| George E. Stratton | 15 00 |
| L. L. VanSlyke | 51 78 |
| H. B. Gorler | 96 10 |
| E. L. Hildreth & Co | 111 37 |
| J. O. Sanford | 19 95 |
| Hotel Pavilion | 67 25 |
| Orrin Bent | 47 00 |
| C. E. Westgate | 2 35 |
| F. Blanchard | 10 00 |
| George E. Stratton | 39 33 |
| J. L. Hills | 6 00 |
| E. L. Hildreth & Co | 5 25 |
| Free Press Association | 55 75 |
| E. L. Hildreth & Co | 22 28 |

| | |
|---|---|
| Paid last year's deficit and interest on money borrowed | $303.10 |
| Paid other bills as per vote of Association, (see Annual Report) | 245 21 |
| Total expenditure | $1,403 97 |
| Total receipts | 1,362 00 |
| Deficit | $41 97 |

Respectfully submitted,

G. W. PIERCE,
Secretary.

HOMER W. VAIL,
Treasurer.

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## ANNUAL ELECTION OF OFFICERS.

FOR 1898.

The annual election of officers of Vermont Dairymen's Association occurred at the close of the session Wednesday morning, and resulted as follows:

President—C. F. SMITH, Morrisville.

Vice-Presidents — { H. W. WALKER, Woodstock.
M. W. CLARK, Williston. }

Secretary—G. W. PIERCE, Brattleboro.

Treasurer—H. W. VAIL, No. Pomfret.

Auditor—GEO. T. AITKIN, Woodstock.

## THE WOMAN'S AUXILIARY OF THE VERMONT DAIRYMEN'S ASSOCIATION.

### ADDRESS OF MRS. C. F. SMITH, PRESIDENT.

I am sure that never in the history of this Association has their annual meeting been under more advantageous circumstances than at the present time.

No organization or association could hold an unsuccessful convention after being received with such warm cordiality as has been accorded us to-day. The very air of St. Albans is freighted with hospitality and good cheer. Nature's beauties which have been bestowed with such a lavish hand in and around this "City by the Sea" must be a means of inspiration. Members of these associations, our hearts should throb with gratitude that so many of us are permitted to be in this beautiful town on this occasion and enjoy the hospitality of this most hospitable people.

May our friends derive such benefits from these conferences as shall commensurate in part at least for the efforts they are making for our convenience and pleasure.

Since the greatest honor to a house are the friends who frequent it, and since we have come to St. Albans as friends to a house, may we prove an honor to our entertainers.

Ours was the pioneer state to have her dairy farmers united in a co-operative association, and for twenty-eight years the Vermont State Dairymen's Association has ever been "the watchman upon the tower" to proclaim to the farmers every new idea both scientific and mechanical which has been introduced into the dairy world, and the agitation and consideration of these new ideas from year to year has brought the dairyman in touch with the various progressive schemes and inventions which have been of untold value to him, and taken him in a little over a quarter of a century from the dairy methods used by our grandfathers to

those which we are using so successfully to-day: and what is the reward for this onward and upward educational march which you have been engaged in? Brother dairyman, are you not indulging in a little pardonable pride that your little Green Mountain State produces more butter per cow and per acre than any other State?

Are you not glad that in quality Vermont's dairy products —like her soldiers in the Rebellion—are found in the foremost ranks?

Do you think without these years of investigation and deliberation on the part of the dairymen, that our little state would have within her borders the largest creamery in the world?

Had the dairy business been conducted with less wisdom or with less persistency to secure the most in quantity, the best in quality, could many of our brother farmers have lived through the past years of financial depression and kept their homes?

That your Association has been instrumental in no small degree in elevating and educating the rural population of our state to a higher, more intelligent and useful plane, no one will deny, but is this all? Is it not because of Vermont's example that dairymen's associations have been organized and are doing very effective work, in no less than twenty-six states?

So have you not reason to be glad that "the candle which was lighted has not been under a bushel, but on a candle-stick, and has been giving light to all around?"

My friends, may you as an organized body, not be content to live on your achievements but courageously grasp and rightly solve the problems which are even now claiming your attention.

The owners of maple sugar orchards in our state are looking to the Vermont Maple Sugar Makers' Association to point out the way to more successfully conduct this important industry. Though but a child in years it has already accomplished much good, and we are sure it will not fall below the expectations of the producers.

We can but hope that they may deliberate, in the sessions immediately following the dairymen's meeting, in such a way that the knowledge and confidence thus obtained, together with the era of prosperity which we were promised should be inaugurated last March, may enable Vermont maple sugar makers to successfully compete, in quantity, quality and remuneration with the manufacturer of Vermont maple products in some of our cities.

That great prosperity may crown your future efforts we trust that the several members of the associations here represented will remember that the success, or existence even of these societies, depends entirely upon the loyalty and support of the individual members.

## PROF. VOORHEES' ADDRESS.

*Ladies and Gentlemen of the Vermont Dairymen's Association:*

As a boy I had a great desire to visit our celebrated Green Mountain State. As a man, a farmer and dairyman, I have had strong desire to meet the dairymen who are able to secure the highest average product per cow of any state in the Union. This is the first opportunity I have had to visit Vermont, and the reception I have received, and what I have already seen and felt, leads me to believe there is not anybody in that semi-tropical state of New Jersey but will agree with me that Vermont is a delightful state in which to live—in summer.

My subject was not assigned me, and yet after my friend and able colleague sent me the proceedings of your last meeting I somewhat changed my paper, because what I had in mind was presented to you in part last year, but I have what I hope will be of service, as it has a direct application in our every-day life. The subject, as I have outlined it, is about as follows:

### THE COMPOSITION OF FOODS, AND SUGGESTIONS AS TO THE METHOD OF PURCHASE OF BREAD, MILK AND BREAKFAST FOODS.

The question of human foods, though of prime importance, has received but little attention until quite recently. There are doubtless good reasons why animal foods should be investigated first, though there are many reasons which suggest that priority of study should relate to those adapted for human use. The investigations thus far have been chiefly directed along two lines, first, a study of the chemical composition of the various food products, and second, an investigation of their present use by the various classes of people. These studies enable us to indirectly arrive at the amounts and proportions of nutrients required to

properly supply the needs for energy under the various circumstances under which it is expended. But little study has yet been given to the question of digestibility and the influence of various methods of preparation of foods upon both palatability and digestibility, which would seem to be of very great practical importance. The human animal, unfortunately perhaps, differs from the lower orders in possessing in a greater degree, *taste*, which influences the use he may make of food, and palatability which undoubtedly influences the rate of digestion—the palatability of the food sometimes increasing the ease of digestion and sometimes decreasing it. To be sure, the method of cooking may exert a favorable influence upon the palatability, as well as directly increase the digestibility, though these two points cannot be well expressed in terms of analysis. I think these points are well understood by all; we know that it is not so much the composition of a food as some other characteristics that we perhaps cannot fully describe that contribute to our best use of it. For example, there is hardly a man but who believes that with the same things in the kitchen, there is no cook that can handle them quite so well as his mother. That is, the food of his mother's cooking does him more good than any other. In these days of plenty, it is seldom that a person lacks for actual nutrients, yet he is frequently illy nourished, because the nutrients are not prepared in a pleasing form.

In order that we may get an intelligent view of the matter, let us briefly discuss human foods in general and their characteristics. Anything to serve as food must contain at least one of the four classes of compounds, protein, fat, carbohydrates or mineral salts, and in order that a food may completly nourish the system, it must contain all of these compounds in digestible forms, and to do so at the least expense of money or of energy, they must exist in certain definite proportions. Is is also a recognized fact, that the demands for both the quantity and proportion of these compounds depend upon a variety of conditions, hence a food well adapted for one condition may not be well adapted for another. That is, while the energy stored

up in the food is in all cases partly expended for repairs, in one case a larger proportion is required for growth or building up of structure, in another it is required for heat, and in another for physical energy, so that the adjustment of the different classes of compounds is an important matter. For example, in physical child-building, we first need the structure—we desire it to be strong, in order to withstand the adverse conditions of life. We, therefore, furnish in greater proportion in the food the constituents that form bone and brain and muscle; these are not contained in the sweets, which are made up of the fuel elements and which furnish heat alone, and with which many children are fed, but in the easily digestible materials, which contain the muscle and bone elements. The grown structure may be maintained with just sufficient of the muscle elements to supply the necessary repairs. Now the muscle, brain, nerves, etc., contain the element nitrogen, and the building up or repair of these cannot be accomplished unless the food contains it, hence muscle builders are nitrogenous, and the compounds containing it are included under the general name protein. Hence, foods which are especially useful for this purpose are classified as nitrogenous, and include the meats, as beef, mutton, poultry, fish, milk, cheese, eggs, in the animal kingdom, and peas, beans and certain cereal grains, in the vegetable. While protein is capable of furnishing heat for the body, its chief function is to supply and repair the waste of the nitrogenous substances of the body. The heat-producing and strength-giving foods, and those which by no possible means can supply the nitrogen, are called "carbonaceous," and include fats, both animal and vegetable, and starch and sugar, chiefly of the vegetable kingdom—these are often spoken of as the heating and fattening foods, and because of the palatability of the sugars are often used in great excess. The mineral food necessary for the purpose of digestion and for the building up of the bony structure of the body, is found in the vegetable foods; the chief source is the cereals, though under any reasonable method of diet a sufficient amount is usually supplied.

It is obvious, therefore, that owing to the requirements of the body not only for different classes of compounds, but for different proportions of them, and owing to the fact that these compounds do not exist singly or in the proper proportions for all purposes in any one food, it becomes necessary to know something of the composition of the various products and ordinary daily requirements of the system for the different nutrients. In a paper of this character any helpful discussion of the composition of the various products would be tedious and tiresome, and since tables of analysis are available to all in the reports of the department of agriculture, I shall merely cite the composition of a representative product of the three different classes, viz ; beefsteak, potatoes, and butter.

ONE POUND CONTAINS

| | Protein. Lbs. | Fat. | Carbo-drates. | Calories. |
|---|---|---|---|---|
| Beefsteak (sirloin).... | 8.155 | .174 | | 970 |
| Potatoes ............ | .018 | .001 | .152 | 320 |
| Butter ............... | .010 | .850 | .005 | 2550 |

It will be observed that the meat furnishes the larger portion of the protein, the potatoes the carbohydrates, and the butter the fat, the three classes of compounds necessary to a proper ration. In reference to the amount and proportion of these that are required, it has been estimated from the results of careful studies, that a man of 150 pounds weight, at moderate work, to keep his body well nourished, requires about .28 pound of protein and sufficient quantities of fats and carbohydrates to furnish, together with that of the protein, about 3,550 calories of potential energy.

He will also need a certain amount of mineral matters and water.

The following would meet his requirements.

NUTRIENTS AND WATER IN FOOD FOR A DAY.

| | Pounds. | Calories. | Ounces. |
|---|---|---|---|
| Protein | .28 | 520 | |
| Fats | .28 | 1,180 | |
| Carbohydrates | .99 | 1,845 | |
| | | 3,545 | |
| Mineral matters | | | .05 |
| Water, in food and drink | | | 4.40 |

Total, 6 pounds, furnishing 3,545 calories of potential energy.

These substances would be contained in the following food materials, which would, therefore, suffice for a day's nourishment:

FOOD RATION FOR ONE DAY.

| | Pounds. | Calories. |
|---|---|---|
| Beefsteak | 0.70 | 600 |
| Bread | 1.40 | 1,790 |
| Potatoes | 1.60 | 510 |
| Butter | 0.18 | 650 |
| Water | 2.21 | |
| Total | 6.00 | 3,560 |

Now, it is evident that while these amounts and proportions of food compounds may be sufficient to nourish the body, no account is taken of the man or his tastes and desires. The ration is substantial, healthful and undoubtedly can be made palatable, besides substitutions of other materials can be made from day to day and from meal to meal, in order to furnish variety, and it then rests with the intelligent housewife to properly interpret the various individualities of her household, in order to cater to the peculiar needs of each, just as the successful dairyman mixes his feeds in good proportions, makes them as palatable as possible, and gives to each that amount found to be necessary.

In view of the fact that only general principles can be followed with any degree of safety and the impossibility of giving detailed instructions along this line, I propose to discuss a feature of the food question which I hope will be of practical interest in showing, first, the advantages of a knowledge of the composition of foods in the economical purchase of certain of our supplies, and second, in showing that notwithstanding the fact that we may have a knowledge of the general composition, we are liable to pay varying prices for the nutrients contained in them, because of the present methods used in their sale. In other words, to show that certain foods of common use are really, for want of a better term, "indirectly adulterated," and that we frequently pay exorbitant prices per pound for the nutrients in the common cereals used as breakfast foods, because we either desire to reduce the labor of preparation, or are influenced by the extravagant claims made for the nutritious qualities of various preparations.

### BREAD.

First, as to the matter of direct adulteration, which consists in adding to a food any substance for the purpose of debasing its value, or in any way altering its physical properties, color, taste, etc. According to this generally accepted definition of the term, the materials added to food for any of the purposes mentioned may not be injurious to health and, therefor, only result in furnishing the consumer with a substance of less commercial value than the original or genuine product. This distinction may be made clear by the following example: Strained honey is frequently adulterated with invert sugar and glucose, yet both glucose and invert sugar are not considered in any way prejudicial to health, and have a food value probably fully equal to the pure honey. In the same manner coffee, maple syrup, lard, mustard, pepper, butter and a number of others, the adulteration consists in adding some substance which does not materially reduce the nutritive effect of the food, yet by this definition of the term is adulteration.

It is this innocuous form of adulteration which I desire to discuss briefly, and then to show that there is such a thing as indirect adulteration of such common food products as bread and milk, or in other words, that under present methods of selling unadulterated bread and pure milk the consumer is frequently quite as seriously defrauded as in the purchase of certain other products which are adulterated by means of added substances of less cost than the product which he is supposedly buying. Take again the question of honey. A recent report on the examination of human food products in the State of Connecticut shows that 50 per cent of the samples of comb honey contain glucose, and that of the strained honey, 86 per cent of the total number of samples examined were adulterated with glucose or invert sugar. Now, inasmuch as these added substances were perhaps quite as nutritious and as healthful as the pure honey, and furthermore could not be distinguished from pure honey by the consumer, he was injured only in that he paid honey prices for substances which could be purchased at a much less cost. Or, as a further illustration, take the question of lard, which is, according to the same report, adulterated to the extent of 40 per cent with various vegetable oils. From the standpoint of fuel value, the adulterated lard stands quite as high as the pure leaf lard, and the consumer was injured only in so far as he paid lard prices for cheaper substances. The same is true of butter and a number of our other common foods.

These forms of adulteration are, of course, the direct result of our progress in the application of chemical science; the chemist discovers some substance which possesses similar nutritive qualities and which does not materially change the character or appearance of the substance to which it is added, but which may be secured at a much lower price, thus injuring the consumer only in the sense that he pays more for a substance than he would if he knew its genuine character.

Assuming that this form of adulteration results virtually in securing a higher price for certain substances in a disguised

form than they would bring if their exact character were known, and that this is the only serious result that follows, it is pertinent to inquire whether the consumer may not be paying varying prices for the nutrients in bread and in milk, and that these variations may result in an exorbitant charge for the nutrients, though in the case of bread, the composition is practically uniform, and in the case of milk the price per quart is identical.

In an investigation recently conducted, it was found that the price of bread, which represented the dealers of four cities, ranged from 3 to 10 cents per loaf. Of these, five cost 10 cents per loaf, the average weight of which was 899 grams, and the average cost per pound of bread was 5.3 cents. It was shown, however, that there was a wide range between the weight of the lightest and the heaviest loaf, in other words, the lightest loaf cost at the rate of 6.6 cents per pound, and the heaviest 4.4 cents per pound, or a difference of 50 per cent.

In the second place, it is shown that there was a lack of uniformity on the part of the bakers in regard to the fixing of prices, the difference in weight of the same priced loaf ranging from 21 per cent, for a 7 cent loaf, to 91 per cent, for a 6 cent loaf. Taking the average of 2.7 cents per pound for the 3 cent loaf, and 5.3 cents for the 10 cent loat, we find that the consumer pays just about twice as much for his nutrients in the one bread as in the other. If the composition of bread does not vary sufficiently to give the consumer of the 10 cent loaf twice the amount of nutrients given to the consumer of the 3 cent loaf, he is defrauded quite as much as if the price per pound in each case were the same, and the one were diluted or adulterated with innocuous material to the extent of one-half. The consumer who purchased the adulterated honey, previously referred to, paid really less per pound for the one containing cane sugar than the one containing pure honey; that is, he paid less for his actual nutrients, though the one containing the cane sugar, which cost 18 cents per pound, furnished quite as much as the one costing 25 cents per pound, and consisting of pure

honey, yet the difference between the market price per pound of cane sugar and of pure honey was relatively no greater than between the cost per pound of bread in several of the instances mentioned, though no adulteration had been attempted. So, too, the consumer who purchased the lard which contained vegetable oils instead of lard, paid really less than for pure lard, though he obtained quite as much actual nutritive matter in the one case as in the other.

A chemical examination of the bread, made to determine whether the variations in the composition bore any direct relation to the variations in the cost, showed that the chief variations were in the content of moisture and of fat, and that neither was sufficiently variable to account for the differences in the prices charged, in fact the composition was so nearly uniform in the different loaves, that the differences in cost per loaf were always accompanied by an increase or decrease in the cost of nutrients, the variations in fat being evidently due to slight additions of butter or lard, and the variations in protein due to the addition in some cases of milk, which shows a higher content of protein than the flour used. In fact the percentage of protein, which is the substance least affected by the difference in methods of making bread, is remarkably uniform in amount for the different breads.

In view of the very great variations in the cost of the nutrients in bread, all of the samples of which represented products of good quality from an edible standpoint, two experiments were conducted to show the relative cost of the nutrients in raw materials and in bread. That is, the differences were so great as to indicate that charges by the baker were so variable and so large as to enable him to conduct his business in a very loose way, and still carry it on at a profit. For example, the actual nutrients contained in bread that would cost $100 in the form of flour, butter, lard, yeast, etc., would cost if bought in the form of bread, $249, or a charge of $149 for making into bread materials that cost $100.

It would seem from these data, that the inducement to actually adulterate bread is very slight, because the consumer is willing to pay, not only very large, but varying prices for the nutrients contained. This willingness is due in large measure to the ignorance or indifference of the consumer, probably both, concerning the relations that should exist between the price of a loaf and its weight. It is hardly likely that a person who uses in his family a thousand pounds of bread a year, and possessed full knowledge of the facts, would be willing to pay $53.00 for it when purchased in the form of a 10-cent loaf, when he could secure the same nutrient, both in kind, quality and amount, for $27.00 when purchased in the form of a 3-cent loaf.

## MILK.

Milk furnishes another example. At the same price per quart any variation in cost of the nutrients furnished must be due entirely to the difference in the quality. While milk is not regarded as a product of fixed composition, since both the total amount and the proportions of the constituents contained in it are influenced by a variety of conditions, it has not occurred to many, that the individuality of the cow, her breed, food, age and health, and period of lactation, would so influence quality as to make a serious variation in the cost of nutrients.

In the samples obtained from one city, the variation in "total solids" ranges from 11.82 per cent to 14.03 per cent, or a difference between highest and lowest of 2.21 pounds per hundred, or 18 per cent. The variation in fat ranges from 2.99 per cent to 4.57 per cent, a difference of 1.58 pounds per hundred, or 50 per cent. In the samples from another city, the "total solids" range from 10.81 per cent to 14.86 per cent, a difference of 4.05 pounds per hundred, or 37 per cent, while the fat ranges from 2.56 per cent to 6.92 per cent, a difference of 4.36 pounds per hundred, or 130 per cent. In the samples from another city, the percentage of "total solids" ranges from 10.64 per cent to 4.80 per cent, a difference of 3.32 pounds per hundred, or 31 per cent. The fat ranges from 2.97 per cent to 4.80 per cent, a dif-

ference of 1.83 pounds per hundred, or 61 per cent, and in one sample only does there appear to be an abnormally low content of "total solids" and fat. In the samples from another city, the range in "total solids" is from 12.06 per cent to 16.55 per cent, or a difference of 4.49 pounds per hundred, or 67 per cent. The range in fat is from 3.28 per cent to 7.76 per cent, a difference of 4.48 pounds per hundred, or 138 per cent.

In fact, the milk falls into eight distinct classes, each class showing a difference of ½ per cent in the content of fat, which shows at once that at a uniform price per quart, there is a wide variation in the cost of the nutrients to the consumer. Assuming for the present, that the quality of the nutrients, as represented by the "total solids," is quite as good in one class of samples as in another, the cost per pound of "total solids" in class one, at the rate of 8 cents per quart, or 4 cents per pound,* is 35 cents, while in the eighth class, it is 26 cents, or 38.5 per cent greater in class one than in class eight. In other words, $100 spent for milk of the quality represented by the eighth class would purchase nutriment that would cost $138.50, if purchased in the form of milk of the quality represented by class one.

In view of this discussion, I do not wish to be understood as favoring in any way any method of adulteration, for I am firmly opposed to it, not only on the ground that its practice is a menace to the public health, but that in the long run it is injurious to our commercial interests. My purpose is to show, that in the purchase, under present systems of sale, of such common, though useful articles of food, as bread and milk; the consumer is in many cases indirectly defrauded, and second, the importance of studies, the purpose of which is the education of the masses concerning the composition, the nutritive quality, and the relative cost of the nutrients in the various articles of human food.

### BREAKFAST FOODS.

These foods may be regarded as of two distinct classes; the first includes wheat and buckwheat flour, to which has been ad-

*On the average a quart of milk will weigh 2.15 pounds.

ded leavening substances, the chief purpose of which is to shorten the time required in preparing the plain flour for the table. The second class includes wheat, oat, maize and rice products, in which the object of the preparation has been to increase their nutritive qualities—this is accomplished either by the removal of the less digestible portions, as the woody fiber, or by the greater concentration in them of protein and fat. It is claimed for many of the products that the special method of preparation very materially increases the ease of digestion of the nutritious compounds, that is, the nutrients in the preparation are more readily and completely digested than in the original product—this is accomplished by partial cooking or by such manipulations as will "convert indigestible starch into digestible sugar." Our study of this subject will, I think, be more helpful if the discussion is confined to the following lines:

I. The cost per pound of the different foods.

II. The variations in the composition of products of the same kind.

III. The comparative composition of foods derived from the same source.

IV. The changes in the composition of wheat and buckwheat flour, due to added leavening or other materials, and the increased cost of nutrients caused by these additions.

V. The comparative cost of nutrients in the different prepared products.

### I. THE COST PER POUND OF THE DIFFERENT FOODS.

The widest range in cost per pound occurs in the prepared flours. In the prepared wheat flour the lowest cost is 4.1 cents and the highest 7.1 cents, a difference of 3 cents per pound, or a range of 73 per cent between highest and lowest. The price per pound was as low as or lower than 4.5 cents in but two cases, it exceeded 6 cents in but five cases, with an average of 5.6 cents with the noted exceptions—but slight variations from

the average were observed in the preparations of the same kind from different dealers.

In the prepared buckwheat flour, the lowest cost per pound is 4.1 cents, the highest 7.0 cents, an average of 5.1 cents, or a range of 70 per cent between highest and lowest.

No special claim is made for these flours, either as to high nutritive quality or improved digestibility.

The "Aunt Jemima" and "Aunt Maria" pancake flours are claimed to be a mixture of wheat, corn and rice, while the "Occidental Pancake Flour" is claimed to be 60 per cent wheat, 32 per cent corn and 8 per cent salt and leavening.

Of the prepared wheat foods, the variation in price per pound of products of the same kind is not great—the widest occurring in "Wheatlet," where the lowest is 7.0 cents and the highest 8.2 cents, a difference of 1.2 cents per pound, or a range of 17 per cent.

In the oat foods, the range is from 5.0 cents to 7.7 cents per pound, a difference of 2.7 cents, or a range of 54 per cent. Four samples represent products sold in bulk; the range in price of these is from 4 to 5 cents per pound, with an average cost of 4.5 cents per pound. The average cost per pound when sold in packages is 6.4 cents, or an increased cost of 42 per cent when purchased in this form.

In the maize foods, hominy ranges in price from 4.1 cents to 5.1 cents per pound, a difference of 24 per cent between the highest and lowest.

Of the wheat products, the most expensive food is the "Granose Flakes," which costs on the average 23 cents per pound. The next in order is "Jackson's Granula," which costs on the average 16.6 cents per pound; the next is "Shredded Wheat," with an average of 15.6 cents per pound; the next is "Wheatena," with an average of 11.8 cents per pound, and the next is "Farina," costing on the average 10.3 cents per pound.

The relatively high cost of these products is doubtless due in part to the expense consequent upon their special method of preparation, which entails a considerable waste of the original

product, and it may be that in these foods, the claims made as to their health-giving qualities and special nutritive value also influence the price. Take, for example, "Granose Flakes," this is claimed to be "a particularly healthful food"; while "Jackson's Granula" is claimed to be "one of the cheapest foods in use, since one pound of it contains more absolute nutriment for brain and body than an equal weight of any preparation in the market, and it is also said to be cooked, ready for use." "Shredded Wheat Biscuit" is claimed to "contain all the elements of nutrition and in the correct proportions to properly sustain the human body." "It is whole wheat—no flour or meal is used in its preparation; no yeast, baking powder, soda, saleratus, cream of tartar or alum are added." "No fermentation." "No greasy substances." "Wheatena" is claimed to be "a complete food, supporting human life perfectly, and replacing all waste of body and brain." "The starch contained in the grain is converted into a soluble substance." "Rich in the phosphatic elements." "Abundant in nitrogen and deficient in starch."

These claims, extravagant in some instances, should have but little weight with consumers, as the actual amount of nutriment furnished in a definite weight does not greatly differ.

No special claim is made for "Farina," which is more often used for puddings and desserts than as a preparation for breakfast.

"Pettijohn's California Breakfast Food" makes quite as strong claims as many of the others, viz: "The hull or covering, or woody matter, is entirely removed, leaving only that part of the grain containing nutritious qualities so valuable in building up the muscles of the system, and the phosphatic matter most valuable as a nerve and brain tonic." "As it is entirely free from bran, it is not irritating to the stomach or intestines, and is most easily digested," yet it is the cheapest of all of the wheat products, with an average cost of but 6.3 cents per pound, less than half as much as three of the products already discussed. The chemical analysis shows it to contain on the

average about the same amount of total nutriment derived from the same product, wheat, as that contained in the higher priced products. It is,therefore, difficult to discover how it is possible to increase the value of the latter two and three-fold even, by changing the proportion of the constituents, by improving the palatability or by increasing the digestibility to the fullest extent.

The average cost per pound of "Cream of Wheat" is 9.1 cents. It is claimed to be "almost pure gluten, and is highly recommended for the use of diabetic persons or those of weak digestion." "Made from selected hard spring wheat, sterilized." The claim that it is almost pure gluten is not warranted by the facts, since, with two exceptions, it contains more nitrogen free-extract, chiefly starch, than any other of the wheat foods examined, while seven of the foods contain more protein (gluten) than the "Cream of Wheat."

"Ralston's Health Wheat Food" is more reasonable in price than many others, viz.: 8 cents per pound. Its claims are "made from Kansas hard wheat." "The richest in flavor of any." "The greatest nerve, muscle and brain food." "Contains more nitrates and phosphates than any other food." In reference to the matter of nitrates, it may be said that while the manufacturers may be honest in their claims, it is quite evident that either they are ignorant of the principles of nutrition, or that they assume that consumers are attracted by terms not usually applied to food products, for while nitrates may result from the oxidation of nitrogenous organic matter, they possess no nutritive value, hence if they existed in products of this sort, which is hardly possible, the value of the product would be reduced rather than increased.

The oat products, though called by different names, as "Nudavene Flakes," "Avena," "Rolled Oats" and "Oat Meal," show pratically the same amounts and proportion of nutritious compounds; "Hornby's Oat Meal" is the most expensive, viz.: 7.6 cents per pound, while the average for the whole is 6.4 cents. The Hornby product is the only one in which the

claims made are at all extravagant—it is said to be "prepared so as to convert indigestible starch into digestible sugar." "Free from hulls, oily substances, specks and insect eggs." "Steam cooked." "Analysis:

| | |
|---|---|
| Nitrates (muscles) | 19.39 per cent. |
| Carbohydrates (heat and fat) | 73.27 per cent. |
| Phosphates (brain and nerves) | 3.34 per cent. |
| Water | 4.00 per cent. |

Analyses prove these oats to possess a larger proportion of brain and muscle producing elements than any vegetable, flesh or other cereal fooa now used by man."

## II. THE VARIATIONS IN THE COMPOSITION OF PRODUCTS OF THE SAME KIND.

By products of the same kind is meant those sold under the same name, as, for example, of the wheat foods, "Farinose," "Germea," "Wheatena" and "Wheatlet." A study of these shows that the variations in their composition are not marked, and that such as do occur are probably due to the variations occurring in the composition of the original wheat. In the oat products, the protein is the constituent that shows the widest variation, while in the corn and rice products, the chief variable constituent is water. In the different samples of prepared flour, wide variations occur in composition, doubtless due both to variations in the composition of the original flour and to the varying amounts and different character of the leavening materials added. In the wheat flours, the widest range occurs in the content of protein, the lowest is 8.04 per cent, and the highest 13.31 per cent. The ash ranges from 3.63 per cent to 7.06 per cent. There is also a considerable variation in the water content, ranging from 9.58 per cent to 11.82 per cent. The nitrogen free-extract, or carbohydrates, being obtained by difference is also affected by the variations in the content of the other constituents.

In the "Buckwheat Flours", the protein ranges from 4.38 per cent. to 11.12 per cent., the ash from 4.43 per cent. to 6.94

per cent., while the water ranges from 9.80 per cent. to 13.56 per cent.

### III. THE COMPARATIVE COMPOSITION OF FOODS DERIVED FROM THE SAME SOURCE.

A study of the composition of products derived from the same source shows that of the wheat foods, "Parched Farinose" and "Wheatena" agree very closely in their composition, and are much richer in fat and protein than any other of these products, though they are not sufficiently rich in these constituents to bear out the claim that "they approach very nearly in their composition a perfect or complete food." "Granose Flakes", "Wheat Germ Meal" and "Health Wheat Food" are almost as rich in protein, but contain only about one-half as much fat as the "Parched Farinose" and "Wheatena." "Wheatlet", "Cream of Wheat" and "Granula" are quite similar in their composition, showing about 12.5 per cent. of protein and 1 per cent. of fat. "Shredded Wheat Biscuit" and "Pettijohn's California Breakfast Food" are also quite similar in composition; the "Breakfast Food" showing a little more fat than the "Shredded Wheat Biscuit". "Germea" contains the lowest percentage of protein of all the wheat products, an average of but 9.13 per cent.

The oat products are very much richer in both protein and fat than any of the wheat products and are, therefore, correspondingly poorer in nitrogen free-extract. "Hornby's Oat Meal" shows a high content of protein and fat, and thus in some degree verifies the claim that "it is richer in the elements of nutrition than any other cereal food."

Of the maize products, "Cerealine" is much richer in both protein and fat than hominy, though both are much richer in starchy matter, or nitrogen free-extract, than any of the wheat or oat products.

Of the rice products, the "Flaked Rice", while showing less of both protein and fat than the "Cerealine" and "Hominy" is richer in these constituents than the entire rice grain.

### IV. THE CHANGES IN THE COMPOSITION OF WHEAT AND BUCKWHEAT FLOUR DUE TO ADDED LEAVENING OR OTHER MATERIALS, AND THE INCREASED COST OF NUTRIENTS CAUSED BY THESE ADDITIONS.

In the case of the prepared flours, the chief object, as already stated, is to save the time of the housekeeper in their preparation for the table. The difference in composition between the plain flour and the prepared products is chiefly in the proportion of the constituents caused by the addition of leavening material. In the case of wheat flour, a comparison of the average composition of standard brands with the average composition of the prepared products shows that in the latter the ash constituents are largely increased, and the other constituents proportionately reduced—the ash being increased from less than one-half per cent. in the plain flour to nearly 5.5 per cent. in the prepared flour. The fat remains nearly the same, while the protein and carbohydrates are reduced; the water content in the prepared products is, however, lower than in the plain flour, thus showing an actual decrease of but 3.55 per cent. in the total organic matter due to the added mineral matter. Even assuming that the composition had not been altered in other respects, that is, the food value has not been reduced, the addition of 5.0 per cent. of mineral matter has caused an increase of 75 per cent. in the cost per pound of the product. The average cost per pound of the prepared flour is 5.6 cents, or stated in another way, the nutriment that would cost $3.20 per hundred in the clear wheat flour would cost $5.60 per hundred in the prepared form, or a charge of $2.40 per hundred for leavening material, mixing and putting up into packages. In the case of prepared buckwheat flour, in which the increase in content of ash is quite as great as in the prepared wheat flour, the products are in many cases much richer in protein than the clear buckwheat flour. This may be due both to the fact that buckwheat flour is more variable in its composition than wheat flour, and because in many of the prepared buckwheat flours, wheat flour, which is richer in protein than the buckwheat flour, has been added, thus making the

average composition of the prepared flours much richer in this compound than the plain buckwheat flour, and consequently much poorer in nitrogen free-extract. Thus it is shown that the average of the prepared products is almost as rich in organic nutrients as the whole buckwheat flour, notwithstanding the addition of nearly 5.0 per cent. of mineral matter. The cost per pound of the prepared products is, however, considerably less than in the case of the prepared wheat, viz: 5.1 cents against 5.6 cents, though it is about 70 per cent. greater than the original flour. That is, plain buckwheat flour that would cost $3.00 per hundred would in the prepared form cost $5.10 per hundred, a charge of $2.10 per hundred for the added materials and other expenses.

### V. THE COMPARATIVE COST OF NUTRIENTS IN THE DIFFERENT PREPARED PRODUCTS.

While it is understood that the various classes of nutrients in the different foods possess distinct functions in nourishing the body, the fuel value of foods of the same class furnishes a fair basis for comparison. In the samples examined, the fuel value has been calculated, based upon the average composition of the different products. These results verify in large measure the conclusions already reached concerning the relative economy of the various foods from their cost per pound and chemical composition, as shown in the following table:

FUEL VALUE OF THE FOODS AND CALORIES OBTAINED FOR 10 CENTS.

| NAME. | Fuel Value of 1 pound. Calories. | Fuel Value obtained for 10 cents. Calories. |
|---|---|---|
| Wheat Flour | 1659 | 5122 |
| Prepared Wheat Flour | 1591 | 2841 |
| Buckwheat Flour | 1626 | 5420 |
| Prepared Buckwheat Flour | 1572 | 3082 |
| Flour from Whole Wheat | 1665 | 3872 |
| Pettijohn's California Breakfast Food | 1707 | 2710 |

| | | |
|---|---|---|
| Leggett's Cracked White Wheat...... | 1686 | 2247 |
| Parched Farinose.................... | 1773 | 2333 |
| Wheatlet............................ | 1693 | 2170 |
| Germ Meal........................... | 1665 | 2108 |
| Health Wheat Food................... | 1663 | 2079 |
| Germea.............................. | 1704 | 2078 |
| Cream of Wheat...................... | 1681 | 1847 |
| Farina.............................. | 1638 | 1590 |
| Wheatena............................ | 1795 | 1521 |
| Shredded Wheat Biscuit.............. | 1715 | 1099 |
| Granula............................. | 1694 | 1069 |
| Granose Flakes...................... | 1695 | 737 |
| Oat Meal............................ | 1864 | 2913 |
| Hominy.............................. | 1669 | 3477 |
| Cerealine .......................... | 1694 | 1435 |
| Rice................................ | 1641 | 2051 |
| Flaked Rice......................... | 1686 | 1258 |

For example, while a pound of wheat flour or prepared wheat flour does not differ materially in fuel value, 10 cents will purchase nearly twice as many calories in the former as in the latter. In the wheat foods, 10 cents will purchase more than twice as many calories when in the form of Breakfast Food, Cracked Wheat or Wheatlet than in the form of Shredded Wheat. That is, the cost of nutrients in products of practically the same kind vary more than 100 per cent, when purchased in the different materials. The composition alone, or statements concerning their improved quality, are not safe guides in the purchase of the commoner foods, and which contribute largely in the making of our dietaries. We need to study not only how to provide the proper proportions of the nutritious compounds, but how to purchase them in order that true economy may be practiced.

DISCUSSION OPENED BY MRS. A. A. C. WARE.

Mrs. Ware spoke of the great necessity for skilled labor in the home. She said the art of housekeeping should not be

neglected. Domestic science should be taught in all our public schools and colleges. In closing she asked Professor Voorhees for his ideas regarding the use of butter, cheese, potatoes, shredded wheat, skimmed milk and whole milk as food, also the effect of food upon character.

Prof. Voorhees—I do not believe the average American eats too much good butter, but think he eats too much fat. Our rations are one-sided, there is not sufficient nitrogen in them. When we learn that we can make good meat better by making it leaven we can adjust the matter. Cheese is a nutritious food and should be used freely. I cannot say enough in favor of both whole and skimmilk. Use the skimmed milk with fatty rations. Some people do well on whole milk while others cannot use it but can use it skimmed.

Concerning the potato, there is no doubt of its value. The trouble comes from using it too much. Shredded wheat is an excellent material, at the same time it does not contain very different proportions of the grain from other preparations of wheat that are much cheaper, costing only about one-third as much. The fact that it is shredded does not increase its digestibility. I have not any doubt about food influencing the character of a person, but you must begin with the babe and go right along up.

Miss Mamie Tobin, Swanton, gave two readings which delighted the audience.

Mr. C. J. Bell, Walden, Master of the State Grange, in closing his remarks referred to the grange, said it was organized to revive the social life of the farmers, to make the farm more profitable, to assist in better legislation and enforcement of our laws, and to enable us to take time through the short journey of life to enjoy the beauties of nature with which we are so abundantly surrounded, to teach our children to love their home, their state and their God.

Our forefathers fought for and gave their blood like water for this law abiding, God fearing, liberty loving nation, a nation of industry, loyalty and purity. From the records of the gener-

als of the past we are led to believe that from the rural homes come the great and good men who are leaders in both church and state.

Mrs. Smith read an ode written by Mrs. Clayton Cornell of Cambridge.

The St. Albans orchestra furnished beautiful music during the evening.

Meeting adjourned.

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THE WOMAN'S AUXILIARY OF THE VERMONT DAIRYMEN'S ASSOCIATION

held its annual meeting in the Mayor's office, in city hall, St. Albans, Jan. 5, 1898 at 9:30 A. M.

Mrs. Mary A. Smith, Morrisville, president, in the chair. Mrs. Alvira A. C. Ware appointed secretary pro tem. Exercises were opened by singing followed by prayer.

Report of the secretary, Mrs. Ida M. Pierce read and approved. The president in her annual address spoke upon the possibilities for the farmer's wife in the way of improvement and influence, also that our girls at this time ought to be gaining information upon practical subjects at our agricultural college through a well established course of lessons in household science.

Mrs. M. W. Clark, Williston, read the following paper.

### THE PLACE OF SCIENCE IN THE EDUCATION OF WOMAN.

Science is applied to about every condition of mankind. It is causing the ways and customs of yesterday to be set aside for something more practical and useful of to-day.

Take for instance the matter of light. Country people of thirty can easily remember back to the tallow dip as the principal means of illuminating their homes.

Really science has already made such a change in the affairs of woman, that we must concede it a very worthy and

important place in her development. We have passed along to that point where it does not seem to me so important to speak about the value of science to us, as to encourage as much as possible the bringing of theory into more general use.

While we may be slow to admit it, I think we have been more tardy in improving the methods of conducting our homes than our husbands have been in improving their methods on the farm, in the shop or in the office. It is not that they deserve more credit, but because the laws of business are such that they have been obliged to adopt new plans in order to succeed; while with us notwithstanding the farm and the house should be in close relationship with each other, for it is hard for one to succed without the co-operation of the other, yet the laws of science do not seem as imperative with us, and we are quite apt to follow a certain plan or custom because it is our way, or was our mothers' way. With due allowance for many things in which tradition and temperament may cause us to follow our own devices, yet for our best good, that we may receive our full measure of happiness, meet the responsibility and share the burdens of those depending upon us, whether it be husband, children, father, mother, brother or sister, our methods should be the triumph to merit, thorough knowledge of what we may be called upon to do, and a good reason for doing what we do.

What we breathe, what we eat, and what we wear are subjects concerning the household usually left to our supervision and should receive our constant attention. Certainly it must have been a divine hand that formed the organs of respiration; these organs are so delicate that a slight pressure causes pain, yet great quantities of air are constantly passing back and forth through their passages. None of the requirements of the human body are as great as that of pure air; an individual may be ever so particular in the care of his person, but if he breathes from an atmosphere loaded with malaria he is very apt to be prostrated with some form of fever.

Let us ever bear in mind that the air we take into the lungs gives up its oxygen to the blood, and the air we exhale carries off the impurities. Of course we understand this, but do we make the best provisions possible to get rid of this foul air and keep up the supply of fresh, especially in our sleeping rooms?

Old-fashioned houses used to have a fire place in about every room, causing a free circulation. In many instances these houses have been modernized, as we say, and the fire places closed up without so much as putting in a ventilator.

Instead of using a closed cap in the chimney hole when the stoves are taken out in the spring, buy one of the neatly decorated chimney dampers, made at the present time and use in its stead.

The prevalence of intemperance among the lower classes has been attributed to bad ventilation in crowded homes and tenements, which produces a degree of lethargy sufficient to cause a craving for stimulants. What wife or mother that realized this would not most carefully see to the ventilation of her home! Let in the pure air of heaven day and night.

Some object to night air. Florence Nightengale's answer to this objection was: What can we breathe at night, except night air? A person must have pure air while sleeping to assure good health. Obtain it some way but avoid draughts, where you can, though a draught is not so great an incentive to sickness as foul air.

The food we eat should always be prepared in a wholesome way, selecting those most nutritious and easily digested, with a variation of delicacies sufficient to serve as an appetizer.

A person's disposition depends largely upon the condition of the health, and the general health upon the condition of the stomach.

Blood is derived chiefly from the food we eat as is also our strength. Some meats and vegetables are more nutritious than others. I think it is the duty of every woman to try and become familiar with new ways and methods of preparing food.

Those who are near cooking schools would be greatly benefited just by the lectures. When possible it would be well to send our daughters as regular pupils for at least one year. Those of us who cannot do this can help themselves wonderfully by taking some periodical upon culinary science and domestic economics. The December number of the Boston Cooking School Magazine has a diagram of a cow showing the different parts of meat and how to prepare them. It would seem that any one who saw that diagram would be able to do her marketing to better advantage the next week. Most of us like to try a new recipe or make some change in the old and enjoy the interest our daughters take in experimenting with a new one.

Working with them will help us to keep young and here is such an excellent opportunity for a woman's club in the home without any of the objectionable tendencies of some of the organizations that carry that name at the present time.

It is found that many of the ailments that we are subject to are brought on by the sudden changes in our climate.

Flannel underwear worn the year round would serve as a preventative of many kinds of sickness. The more we study this subject the more we can see the desirability of flannel garments. They are not so uncomfortable in summer as many believe, now that they are made nearly as thin as the cotton gauze. The consideration of expense would come to the minds of many of us, but wouldn't we save enough more in our doctor's bill as well as in the comfort of the individual, to cover the extra expense.

Mothers should clothe the tender bodies of their little ones with undergarments of this material. Warmth is almost as essential to healthful developement as food.

I believe the white or light colored flannel is considered the best for summer and winter as they reflect the heat, while the dark colors absorb it. Consider the dress of the school girl; the young lad's dress is always right, for that is loose anyway, and here is where fashion injures so many of our girls, desiring to have them look so trim that to obtain this many

parts of the clothing are worn too tight for their proper development. As a result of better instruction on the subject of clothing public opinion has grown in favor of strong and healthy girls.

With this partial treatment of what we may deem our every day affairs of life in their relation to science, I hope that if there has been nothing new stated, new thoughts will arise which may be an incentive to better sense and work, in what must always be essentially our field of action, namely, the home.

And to us who live, move, and have our being identified with those engaged in the pursuit of agriculture, how essential it is that we train ourselves and our daughters along lines peculiar to that occupation.

The success of agriculture depends as much upon us as upon our husbands. Here is a field worthy of one's most careful thought and attention.

Am I training my daughter to be proficient in the home, and upon the farm? or is she growing up totally ignorant of or even learning to despise the occupation of her parents? Here lies the fate of agriculture as much as in anything connected with it, and one of its brightest outlooks rests in the fact that people are beginning to realize more than ever that a country home can be made the nearest to an ideal home and that a daughter thoroughly trained on the farm is fitted rather than injured to grace any position in the land.

---

Mrs. I. T. Story of Essex, a member of the Auxillary, read a practical and interesting essay at the evening session upon the benefits of personal experience, but it is not printed for lack of space.

It was voted to send to Mrs. F. S. Collins of Burlington, a copy of resolutions expressing our sympathy for her in the death of her husband. Mrs. Mary A. Smith, Mrs. M. W. Clark and Mrs. Anna Dodge were appointed a committee for

that purpose. The question box brought out a large number of questions which called forth much discussion. Then followed the election of officers. President, Mrs. Mary A. Smith, Morrisville; Vice-President, Mrs. M. W. Clark, Williston; Secretary, Mrs. Alvira A. C. Ware, Brattleboro. Singing a familiar verse, in which all joined, was a fitting close to an interesting meeting.

Adjourned to meet again at same time and place as the next meeting of the Vermont Dairymen's Association.

ALVIRA A. C. WARE, Secretary,
Brattleboro, Vt.

### LIST OF MEMBERS OF WOMAN'S AUXILLIARY.

| | | |
|---|---|---|
| Mrs. | Margaret M. Reed | Burlington |
| " | May H. Pitkin | Marshfield |
| " | Carrie A. Nelson | Ryegate |
| " | Anna Dodge | Morrisville |
| " | Mary A. Smith | Morrisville |
| " | D. D. Howe | Burlington |
| " | Mary R. Ralph | Brookfield |
| " | A. L. Walker | So. Woodstock |
| " | Elinor T. Clark | Brookfield |
| " | E. P. Carpenter | Waterford |
| " | S. J. Hastings | Passumpsic |
| " | F. S. Collins | Burlington |
| " | George Crane | Wilmington |
| " | E. J. Bell | Hardwick |
| " | Lura S. Peck | Brookfield |
| " | Maria Peck | Hinesburgh |
| " | L. R. Jones | Burlington |
| " | C. M. Winslow | Brandon |
| " | J. O. Sanford | Stamford |
| " | Mary Kibbes | Brookfield |
| " | Louis W. Clark | Brookfield |

| | | |
|---|---|---|
| Mrs. | A. B. Manchester | Randolph |
| " | T. F. Betterley | W. Brattleboro |
| " | C. H. James | Cornwall |
| " | I. T. Story | Essex |
| " | Alvira A. C. Ware | Brattleboro |
| " | Sarah J. R. Whitman | Brattleboro |
| " | Hazen | Hartford |
| " | Jennie Brensen | E. Hardwick |
| " | Ida M. Pierce | Brattleboro |
| | 1897. | |
| " | Jennie L. Brock | Barnet |
| " | F. L. Smith | Fletcher |
| " | M. W. Clark | Williston |
| " | John Smith | Newbury |
| | 1898. | |
| " | Jennie S. Bentley | St. Albans |
| " | M. A. Curtis | Georgia |
| " | M. B. Fuller | Georgia |
| " | C. E. Martin | Rochester |
| " | E. W. Smith | E. Berkshire |
| " | E. R. Towne | Waterbury |
| " | R. B. Galusha | Jericho |
| " | H. M. Crane | St. Albans |
| " | O. T. Sunderland | Georgia |
| " | M. L. Asaltine | N. Fairfax |
| Miss | Elma Eldred | Sheldon |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES.--CLASS I. (DAIRY TUB.)

| No. | | FIRST PREMIUM. J. B. Dimon, Highgate. | SECOND PREMIUM. C. F. Smith, Morrisville. | THIRD PREMIUM. C. H. Cobb, Westford, |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this butter was made? | Grade Jerseys. | 8 Jerseys. | Grade Jerseys. |
| 2 | How much and what kinds of feed were used per cow? | 4 pounds oat feed; 2 pounds corn meal. | 6 lbs. bran, linseed, corn meal, ensilage, hay. | Bran and gluten, 4 quarts; oat hay. |
| 3 | What is the cost of this ration per day? | 5 cents. | 15 cents. | |
| 4 | By what process or apparatus was the cream obtained? | De Laval Separator No. 3. | Baby Separator. | DeLaval Separator No. 3. |
| 5 | How long was the cream kept, and in what condition when put in the churn? | 24 hours; slightly acid. | One to three days; acid. | 3 days; changed sour. |
| 6 | At what temperature was the cream? Kind of churn used? | 62°, box churn. | 64°. Stoddard Churn. | 58°. Box Churn. |
| 7 | What length of time churning? | 30 minutes. | 30 minutes. | 30 minutes. |
| 8 | Do you wash and salt it while in granular form? | Yes. | Yes. | Yes. |
| 9 | What kind of salt, and how much to the pound? | Genesee salt, ¾ oz. | Worcester. | Worcester, ¾ oz. |
| 10 | What kind of butter color used? | Wells & Richardson. | Thatcher. | Wells & Richardson. |
| 11 | What kind of worker used? | Home made worker. | Waters. | Eureka. |
| 12 | How many pounds of milk required to make one of butter? One or more workings? | 18 pounds. | 15½ pounds. One working. | 16 pounds. One. |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES.—CLASS II. (DAIRY BOX.)

| No. | | FIRST PREMIUM. D. M. Roberts, N. Pomfret. | SECOND PREMIUM. P. W. Strong, N. Pomfret. | THIRD PREMIUM. L. M. Cameron, Middlesex. |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this butter was made? | 6 grade Jerseys. | Ten Jerseys. | 11 Grade Jerseys. |
| 2 | How much and what kinds of feed were used per cow? | 2 lbs. corn meal, 1½ lbs. bran, ½ lb. gluten meal, night and morning, dry corn fodder and rowen. | 10 lbs. meal and bran, hay and corn fodder. | Hay, corn silage, peas and oats, cornmeal and bran. |
| 3 | What is the cost of this ration per day? | Grain ration, 8 cents per day. | Fifteen cents. | About 12 cents. |
| 4 | By what process or apparatus was the cream obtained? | Sharples Hand Separator. | Cooley Creamer. | DeLaval Separator. |
| 5 | How long was the cream kept and in what condition when put in the churn? | Churn twice a week. Cream stands 2 days or until ripened. | 3 days in gathering. Sour. | 48 hours. Sour. |
| 6 | At what temperature was the cream? Kind of churn used? | 64°. Davis Swing Churn. | 66°. Stoddard. | 64°. Stoddard barrel. |
| 7 | What length of time churning? | About half an hour. | 40 minutes. | 30 minutes. |
| 8 | Do you wash and salt it while in granular form? | Wash in granular form. Salt in worker. | Wash, but not salt. | Yes. |
| 9 | What kind of salt, and how much to the pound? | Worcester salt, ½ oz. | Worcester, ¾ oz. | Worcester, 1 oz. |
| 10 | What kind of butter color used? | Thatcher's | Wells & Richardson. | Wells & Richardson Co. |
| 11 | What kind of worker used? | Old fashioned lever. | Lever. | Hand. |
| 12 | How many pounds of milk required to make one of butter? One or more workings? | 15½ pounds. One. | 16¼ pounds. One. | 16 pounds. One. |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES.—CLASS III. (DAIRY PRINTS.)

| No. | | FIRST PREMIUM. G. C. Bean, Coventry. | SECOND PREMIUM. E. S. Martin, Williamstown. | THIRD PREMIUM. Nathan H. Ricker, Ryegate. |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this butter was made? | 18 Registered Jerseys. | 25 cows, grade Jerseys. | 33 thoroughbred and high grade Jerseys. |
| 2 | How much and what kind of feed were used for cows? | 40 lbs. ensilage, 12 lbs. hay, 4 lbs. gluten, 4 lbs. bran. | 8 lbs. hay, 20 lbs. dry ensilage, corn meal, cotton seed, gluten and bran 6 lbs. | 4 qts. bran, 1 qt. ground oats, 1 qt. corn meal, 1 pint of cotton seed, daily. |
| 3 | What is the cost of this ration per day? | 15 cents. | | |
| 4 | By what process or apparatus was the cream obtained? | DeLaval Separator. | DeLaval Separator. | DeLaval Separator. |
| 5 | How long was the cream kept and in what condition when put in the churn? | 3 days, slightly acid. | 30 hours, ripe. | 36 hours. Acid. |
| 6 | At what temperature was the cream? Kind of churn used? | 58°, Davis swing. | 60°, Stoddard. | 63°, Dash churn. |
| 7 | What length of time churning? | 40 minutes. | 10 minutes. | 1 hour. |
| 8 | Do you wash and salt it while in granular form? | Yes. | Wash in granular form. | No. |
| 9 | What kind of salt and how much to the pound? | Worcester, $\frac{3}{4}$oz. | Worcester, $\frac{1}{2}$oz. | Worcester, $\frac{2}{3}$oz. |
| 10 | What kind of butter color used? | Wells, Richardson & Co. | Thatcher's. | Wells, Richardson & Co. |
| 11 | What kind of worker used? | Franklin county. | Waters. | Hand lever with octagon roller. |
| 12 | How many pounds of milk required to make one of butter? One or more workings? | 17 pounds. One. | $16\frac{1}{2}$ pounds. One. | $16\frac{2}{3}$ pounds. More. |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES.—CLASS IV. (CREAMERY TUB.)

| No. | | FIRST PREMIUM. E. E. Symes, Ryegate. | SECOND PREMIUM. F. H. Bickford, Bradford. | THIRD PREMIUM. Wm. V. Beach, Charlotte. |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this butter was made? | Grade Jerseys. | About 900, mixed breeds. | 700, mixed breeds. |
| 2 | How much and what kinds of feed were used per cow? | | | |
| 3 | What is the cost of this ration per day? | | | |
| 4 | By what process or apparatus was the cream obtained? | United States. | DeLaval Separator. | DeLaval Separator. |
| 5 | How long was the cream kept and in what condition when put in the churn? | 40 hours. Acid. | 18 hours. Acid. | 24 hours. Slightly acid. |
| 6 | At what temperature was the cream? Kind of churn used? | 62°, Vt. Farm churn. | 58°. Box churn. | 57°. Box churn. |
| 7 | What length of time churning? | 25 minutes. | 20 minutes. | One hour. |
| 8 | Do you wash and salt it while in granular form? | Yes. | Yes. | Yes. |
| 9 | What kind of salt, and how much to the pound? | Worcester, ½oz. | Worcester ⅛oz. | Worcester, 1oz. |
| 10 | What kind of butter color used? | Wells, Richardson & Co. | Wells, Richardson & Co, | Wells, Richardson & Co. |
| 11 | What kind of worker used? | Vt. Farm. | National. | National. |
| 12 | How many pounds of milk required to make one of butter? One or more workings? | 18 pounds. One. | 17 pounds. One. | 19 pounds. One. |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES—CLASS V. (CREAMERY PRINTS.)

| No. | | FIRST PREMIUM. F. E. SMITH, Fletcher. | SECOND PREMIUM. R. F. JAYNES, Ryegate. | THIRD PREMIUM. CARPENTER BROTHERS, West Waterford. |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this butter was made? | 50, mixed breed. | About 500, Grade Jerseys. | 300, G. Jerseys & Durhams. |
| 2 | How much and what kinds of feed were used per cow? | | | |
| 3 | What is the cost of this ration per day? | | | |
| 4 | By what process or apparatus was the cream obtained? | United States Separator. | U. S. Separator. | U. S. Separator. |
| 5 | How long was the cream kept, and in what condition when put in the churn? | 36 hours; acid. | 18 hours; sour. | 48 hours; slightly acid. |
| 6 | At what temperature was the cream? Kind of Churn used? | 56°; Square box. | 58°; box. | 60°; box churn. |
| 7 | What length of time churning? | 1 hour. | 20 minutes. | 45 minutes. |
| 8 | Do you wash and salt it while in granular form? | Yes. | Wash in granular form. | Yes. |
| 9 | What kind of salt, and how much to the pound? | Worcester; ¾ oz. | Worcester; ⅝ oz. | Genesee salt; 1 oz. |
| 10 | What kind of butter color used? | Wells, Richardson & Co. | Wells, Richardson & Co. | Wells, Richardson & Co. |
| 11 | What kind of worker used? | Fargo. | Vt. F. M. | Vt. F. M. worker. |
| 12 | How many pounds of milk required to make one of butter? One or more workings? | 19 pounds; one. | 18 pounds; one. | |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF CHEESE PRIZES—CLASS A. (DAIRY PLAIN.)

| No. | | FIRST PREMIUM. J. C. OLIVER, Charleston. | SECOND PREMIUM. J. H. RILEY, Sheldon. | THIRD PREMIUM. A. MESSER, Rochester. |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this cheese was made? | 15 cows; G. Dev. & Jer. | 59; Native & G. Jerseys. | 7 cows. |
| 2 | What was their feed? | Corn Fodder and Clover. | Pasturage and Fodder Corn. | Pasture. |
| 3 | Was the milk aerated, and by what means? | Cooled by pouring. | Yes; Elevated Strainer. | No. |
| 4 | What was the age and temperature of milk when the rennet was applied? | One-half kept over night; one-half; ½ hour; 85°. | Night's milk, 12 hours. Morning; fresh; 86°. | Night and morning; 84°. |
| 5 | What preparation of rennet did you use, and how much per thousand pounds of milk? | Calves' rennet; soaked one quart. | Hansen's; 4 oz. | From Factory; 3 oz.; to 1,000 pounds. |
| 6 | Describe your method of procedure through the remainder of process of making. | Cut curd in ½ hour; stand ½ hour; break; draw off whey and warm 3 times till cooked, then drain and salt. | Cooked at 100° for 1 hour or until acid by hot iron showed ¼ inch. | Private Dairy Process. |
| 7 | How long ago was the cheese made? | 64 days. | Sept. 20th. | Made last of July. |
| 8 | How many pounds of milk did you require to make one pound of cheese? | 7. | 9 pounds at this date. | 8⅛. |
| 9 | What was the average net price received for your cheese per pound last season, from May 1 to November 1? | Cheese made in Oct.; 12 cts. | | 11 cents. |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF CHEESE PRIZES.—CLASS B. (DAIRY SAGE.)

| No. | | FIRST PREMIUM. J. C. OLIVER, Charleston. | SECOND PREMIUM. J. H. RILEY, Sheldon. | THIRD PREMIUM. CLARK SIMONDS, Northfield. |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this cheese was made? | 15 cows; Grade Devon and Jersey. | 59 Native and Grade Jerseys. | 8 Durhams and Jerseys. |
| 2 | What was their feed? | Corn-fodder and clover. | Pasture and fodder-corn. | Pasture feed. |
| 3 | Was the milk aerated, and by what means? | Cooled by pouring. | Yes; by elevated strainer. | Yes; by dipping. |
| 4 | What was the age and temperature of milk when the rennet was applied? | Night and morning milk; 85°. | 12 hours old; 86°, | ½ hour; 60°. |
| 5 | What preparation of rennet did you use, and how much per thousand pounds of milk? | Calves' rennet soaked. | Hansen's, 4 oz. | Calves' rennet; 1 tablespoonful to 10 quarts of milk. |
| 6 | Describe your method of procedure through the remainder of the process of making. | One-half hour after rennet is applied, cut curd. | Cool at 98° to ½ inch acid by hot iron; use dry sage leaf. | |
| 7 | How long ago was this cheese made? | 78 days. | August 16. | 4 months old. |
| 8 | How many pounds of milk did you require to make one pound of cheese? | 7 pounds | 9½ pounds. | Don't know. |
| 9 | What was the average net price received for your cheese per pound last season, from May 1 to Nov. 1? | 12 cents. | | 12½ cents. |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF CHEESE PRIZES.—CLASS C. (FACTORY PLAIN.)

| No. | | FIRST PREMIUM. H. M. RICE, Westford. | SECOND PREMIUM. ED. BISSONETTE, Addison. | THIRD PREMIUM. P. MCDONOUGH, Hinesburgh. |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this cheese was made? | 500 cows; mixed breeds. | Mixed breed. | 700; mixed breeds. |
| 2 | What was their feed? | Grass and corn-fodder. | Grass and corn-fodder. | Grass and corn-fodder. |
| 3 | Was the milk aerated and by what means? | Yes; by stirring, | Yes; by dipper. | Yes; by dipping. |
| 4 | What was the age and temperature of milk when the rennet was applied? | Night's and morning's milk; 86°. | Night's and morning's milk; 85°. | Night's and morning's milk: 85°. |
| 5 | What preparation of rennet did you use, and how much per thousand pounds of milk? | Jones' rennet extract. | F. Jones' extract, 4 oz. | Home preparation. |
| 6 | Describe your method of procedure through the remainder of the proces of making. | | Heat to 98°; remain in whey about three hours. | Cut and heat to 100°; hot iron test. |
| 7 | How long ago was this cheese made? | Made in September. | 3 months. | 3 months. |
| 8 | How many pounds of milk did you require to make one pound of cheese? | 10 pounds. | 9 pounds. | 9 pounds. |
| 9 | What was the average net price received for your cheese per pound last season, from May 1 to Nov. 1? | $7\frac{1}{2}$ cents. | $9\frac{1}{2}$ cents. | 9 cents. |

STATEMENT OF METHODS EMPLOYED BY WINNERS OF CHEESE PRIZES—CLASS D. (FACTORY SAGE.)

| No. | | FIRST PREMIUM. T. B. HARRIOT, N. Georgia. | SECOND PREMIUM. ED. BISSONNETTE, Addison. | THIRD PREMIUM. H. L. WARNER, Shoreham. |
|---|---|---|---|---|
| 1 | What number and breed of cows from which this cheese was made? | 400 natives. | Mixed breed. | 450 Grade Jersey and Durhams. |
| 2 | What was their feed? | Pasture. | Grass and corn fodder. | Pasture. |
| 3 | Was the milk aerated and by what means? | No. | Yes, by dipping. | No. |
| 4 | What was the age and temperature of milk when the rennet was applied? | 12 and 24 hours, 86°. | Night and morning's milk, 85°. | One day's milk, 84°. |
| 5 | What preparation of rennet did you use, and how much per thousand pounds of milk? | Hansen's 3 oz. | Jones' Extract, 4 oz. | Hansen's 4 oz. |
| 6 | Describe your method of procedure through the remainder of the process of making. | Set 86°. Coagulated 12 minutes. Cook to 98°. Chedered at proper texture. Salt 3 lbs. to one thousand, in 15 minutes press at 84°. | Heat to 98°. Remain in whey about 3 hours. | Cut as soon as it would break clean. Cook to 94°, take out without acid. Salt 2½ to 1,000, granular process. |
| 7 | How long ago was this cheese made? | | 3 months. | October 25. |
| 8 | How many pounds of milk did you require to make one pound of cheese? | 10 lbs. | 9 lbs. | About 8.5 lbs. |
| 9 | What was the average net price received for your cheese per pound last season, from May 1st to November 1st? | | 9½ cts. | About 85 cts. per one hundred of milk. |

# A LIST OF THE MOSSES GROWING IN THE STATE OF VERMONT

## WITH ANALYTIC KEYS TO THE GENERA AND SPECIES.

By A. J. Grout, Ph. D.

## INTRODUCTION.

Very little has been published on the moss flora of Vermont since the list of Mr. C. C. Frost in the Archives of Science and Transactions of Orleans County Society of Natural History for 1871. Some of the plants then listed were undoubtedly collected outside of Vermont, as is shown by Mr. Frost's labels, and much new information has been gathered since the date of that publication. Unquestionably there are still many species of mosses growing in the State which have not been collected or listed, and it is hoped that this list will aid and stimulate the study of these humble but interesting plants.

With a few exceptions, which are noted later, no species has been admitted to the list without a careful comparison of Vermont material with descriptions or authentic specimens. Specimens from all of the localities cited, however, have not always been examined. The writer has had access to the collections of Mr. C. C. Frost, Mr. C. G. Pringle, Dr. F. Blanchard and to the Columbia University herbarium, which contains duplicates of the Vermont collections of Messrs. C. E. and E. Faxon and Mrs. E. G. Britton. Mr. Edwin Faxon has also very kindly sent a list of Vermont localities and many rare specimens from the Faxon herbarium.

Mr. Frost, in the list referred to above, published a considerable number of species which are not included in this list because there are no specimens of the omitted species in his

collection. In the autumn of 1866 the New England and Vermont State Agricultural Societies held a union fair at Brattleboro. A diploma was awarded by these societies to Mr. C. C. Frost, "For the Specimens of all the Known Mosses of Vermont." This exhibit is bound in two quarto volumes and is deposited in the Museum of Natural History at Brattleboro, Vt., and all the species of Mr. Frost's collection here listed are represented in that collection.

All specimens of Mr. Pringle's collection will be found in his herbarium and the greater part will be found also in the herbaria of the University of Vermont and of A. J. Grout. Most of Mr. Faxon's collections will be found in the herbarium of the University of Vermont and in the Columbia University herbarium; all of those not found there will be found in Mr. Faxon's private collection and many of the rarer ones not at Columbia have been very kindly communicated to the author by Mr. Faxon. Mrs. Britton's collections are in the Columbia University herbarium, also many will be found in the herbarium of A. J. Grout. Duplicates of nearly all of Dr. Blanchard's mosses are in the herbarium of the Fairbanks' Museum, St. Johnsbury, Vt. The mosses collected by the author will be found in his private herbarium and duplicates of all the species will be found in the herbarium of the University of Vermont.

Localities and habitat have been given as fully as possible. Many of the mosses for which only a very few localities are given are undoubtedly common, but have not been collected often enough to warrant that statement.

Keys to the genera and species listed have been added with the hope that they may be found of material assistance to those who wish to study our Vermont moss flora. The keys are comparatively simple because of the small number of genera and species listed. They are mainly compiled from Barnes, Braithwaite, and Husnot.

The arrangement of the acrocarpous mosses follows Lindberg and Braithwaite with one or two unimportant exceptions. The arrangement of the pleurocarpous mosses is less satisfactory

as there is no recent authoritative publication including all of this group. The arrangement of the species in genera follows, so far as is possible, the recent monographs and an attempt has been made to arrange the families according to their natural relationships. Any student of North American mosses knows how great is the confusion in the systematic arrangement of the pleurocarpous mosses. As the present list is not written for the purpose of promulgating any new system of classification but as an aid to the study of our more common mosses, it is hoped that the discrepancies in this line will be condoned as a necessary evil.

With the exception of the species under the genus *Hypnum* the nomenclature is believed to conform to the Rochester Code. In that composite genus the nomenclature of the Manual of the Mosses of North America of Lesquereux and James is retained on account of the changes which must necessarily follow a revision of this group, and also because of the author's decided opinion that a list of this sort is not the place for the publication of a new systematic arrangement. Whenever the name of a plant has been materially changed, the Manual synonym is inserted in italics.

Dr. G. N. Best has very kindly revised the MS. for the Leskeaceae. My thanks are also due to Prof. L. R. Jones, Miss Martha G. Tyler (Mrs. M. H. Buckham), Mr. E. Faxon, Mr. C. G. Pringle, Mrs. E. G. Britton, Mr. M. A. Howe, and others for assistance and encouragement in the preparation of this list.

As the list is provisional and necessarily incomplete, additional data will be gratefully received.

A. J. G.

State Normal School,
Plymouth, N. H.,
Nov., 1897.

## ABBREVIATIONS.

*B*—Mrs. E. G. Britton.
*Bl*—Dr. F. Blanchard.
*F*—Edwin Faxon and C. E. Faxon.
*Fr*—C. C. Frost.
*G*—A. J. Grout.
*P*—C. G. Pringle.

### MOSSES INSERTED ON THE AUTHORITY OF C. C. FROST'S COLLECTION WITHOUT EXAMINATION.

Ditrichum pallidum.
Barbula fallax brevifolia.
Barbula convoluta.
Grimmia Olneyi.
Grimmia Doniana sudetica.
Mnium rostratum.
Mnium hornum.
Leptodon trichomitrion.
Thelia asprella.
Thelia hirtella.
Homalothecium subcapillatum.
Rhynchostegium serrulatum.
Hypnum cuspidatum.
Hypnum molluscum.
Heterocladium squarrulosum.
Physcomitrium pyriforme.

## KEY TO THE GENERA.

1.—Leaves composed of large hyaline cells with intervening rows of small chlorophyllose. cells.* **Sphagnum.**

Leaves with cells all alike except variations in shape and size. 2.

2.—Fruit terminating the axis of stem, or becoming apparently lateral through being pushed aside by a new shoot. **MUSCI ACROCARPI.**

Fruit lateral, not terminating the axis of stem. **MUSCI PLEUROCARPI.**

(See p. 22 for key to Musci Pleurocarpi.)

### MUSCI ACROCARPI.

3.—Capsule opening by 4-6 valves connivent at the summit. **Andreaea.**

Capsule without operculum, opening by irregular transverse ruptures. (Phascum and Bruchia which belong here have been reported from Vermont by Frost, but no specimens have been found in his collection.

Capsule with a deciduous operculum. 4.

4.—Stem none or very short; peristome consisting of a membrane. 5.

Stem distinct; peristome none or formed of separate teeth. 6.

* *Vide* also *Leucobryum.*

| | |
|---|---|
| 5.—Capsule pedicellate, exserted. | Buxbaumia. |
| Capsule subsessile, not exceeding the hair-pointed perichaetial leaves. | Webera. |
| 6.—Peristome formed of four thick teeth. | Georgia. |
| Peristome formed of more than four teeth. | 13. |
| Peristome none. | 7. |
| 7.—Leaves ecostate. | 8. |
| Leaves costate. | 9. |
| 8.—Annual, from a persistent protonema; capsule long-pedicellate. | Schistostega. |
| Perennial; capsule immersed. | Hedwigia. |
| 9.—Leaf cells elongated. | Physcomitrium. |
| Leaf cells isodiametric. | 10. |
| 10.—Capsule ribbed when dry. | Anoectangium. |
| Capsule not ribbed when dry. | 11. |
| 11.—Leaves obovate-oblong, subspatulate, margins plane. | Pottia. |
| Leaves lanceolate, margins more or less rolled. | 12. |
| 12.—Upper leaf-cells empty and clearly defined. | Barbula. |
| Upper leaf-cells minute, opaque. | Mollia. |
| 13.—Peristome single. | 14. |
| Peristome double. | 39. |
| 14.—Teeth articulate. | 15. |
| Teeth not articulate. | 31. |
| 15.—Teeth 16. | 16. |
| Teeth 32. | 20. |
| 16.—Calyptra mitrate. | 17. |
| Calyptra cucullate. | 22. |
| 17.—Calyptra plicate. | 19. |
| Calyptra not plicate. | 18.5. |
| 18.—Lower median leaf-cells linear; hairs of calyptra flexuose. | Weissia. |
| Lower median leaf-cells hexagono-rectangular; hairs of calyptra straight. | Orthotrichum. |
| 18.5.—Leaf cells small, quadrate and punctate, obscure; seta without prominent apophysis. | 19. |
| Leaf cells large, very distinct; seta with a prominent apophysis. | Tayloria. |
| 19.—Calyptra cylindric; beak long-clavate. | Leersia. |
| Calyptra not cylindric; beak long or short, not clavate. | Grimmia. |
| 20.—Teeth from a high tesselated membrane. | Tortula. |
| Teeth from a narrow membrane. | 21. |
| 21.—Areolation lax and hyaline at base, minute, obscure and chlorophyllose above. | Mollia. |
| Areolation small, rectangular and slightly hyaline at base, incrassate, rotundate or quadrate and well defined above. | Barbula. |

22.—Leaves distichous. 23.

Leaves pluriseriate. 24.

23.—Leaves subulate. **Swaartzia.**

Leaves broader, lamina with an extra division at base. **Fissidens.**

24.—Capsule unsymmetric, cernuous-inclined or arcuate. 25.

Capsule symmetric, erect. 30.

25.—Teeth irregularly lacerate or bifid to the middle or below. 26.

Teeth bifid almost to the base.* **Ceratodon.**

26.—Leaf cells not enlarged at basal angles, roundish or quadrate above. 27.

Leaf cells not enlarged at basal angles, oblong above, rectangular at base. 29.

Leaf cells enlarged-quadrate at basal angles. 28.

Leaf cells of 2 kinds in 2 or 3 layers. **Leucobryum.**

27.—Leaves narrow, acuminate, basal cells rectangular; peristome=½capsule. **Oncophorus.**

Leaves larger, acute, lower lateral cells quadrate; peristome shorter. **Dichodontium.**

28.—Leaf cells linear at base; capsule not strumose. **Dicranum.**

Leaf cells rectangular at base, capsule strumose. **Oncophorus.**

29.—Costa broad, flattened and indistinct below; cells of exothecium irregularly oblong and curved, with flexuose walls. **Dicranella.**

Costa narrow and well defined below; cells of exothecium regularly rectangular-quadrate, with non-flexuose walls. **Anisothecium.**

30.—Teeth bifid to the common membranous base. 31.

Teeth deeply bifid or cleft to the base, free. 32.

Teeth cribrose, perforate or slightly cleft.** 33.

Teeth entire. 34.

31.—Leaves smooth, naked. **Ditrichum.**

Leaves smooth, covered at back with a glaucous granular-filamentose excretion. **Saelania.**

32.—Leaf cells not enlarged at the angles, oblong above. **Dicranella.**

Leaf cells not enlarged at the angles, roundish or quadrate above. **Oncophorus.**

Leaf cells enlarged, quadrate or rectangular at the angles. **Dicranum.**

33.—Seta little exceeding the often hair-pointed leaves. **Grimmia.**

Seta long; leaves not hair-pointed. **Barbula rubella and Mollia tenuirostris.**

34.—Capsule with a long, thick apophysis. **Tetraplodon.**

Capsule without apophysis. 35.

35.—Capsule short-pyriform, turbinate when dry. 36.

Capsule ovate-globose. **Drummondia.**

36.—Teeth of peristome blunt. **Seligeria.**

Teeth acute. **Blindia.**

---

* *Trematodon belongs here.*

** *Blindia acuta* may be sought here.

37.—Leaves undulate-crisped when dry. Catharinea.

Leaves not undulate-crisped when dry. 38.

38.—Capsule 4-6-angled. Polytrichum.

Capsule not angular. Pogonatum.

39.—Capsule symmetric, erect. (Sometimes inclined in age.) 40.

Capsule unsymmetric, inclined, oblique, or pendent. 43.

40.—Teeth perfect, linear or filiform. 41.

Teeth broadly or narrowly triangular-lanceolate. 42.

41.—Leaves ecostate; aquatic, floating. Fontinalis.

Leaves costate; not aquatic. Leersia.

42.—Lower median leaf-cells linear; hairs of calyptra flexuose. Weissia.

Lower median leaf-cells hexagono-rectangular; hairs of calyptra straight. Orthotrichum.

43.—Leaves linear. Leptobryum.

Leaves lanceolate or broader. 44.

44.—Calyptra inflated-vesiculose; segments shorter than the teeth or rudimentary. Funaria

Calyptra not inflated-vesiculose; segments nearly equaling teeth in length. 45.

45.—Capsule striate. 46.

Capsule smooth. 49.

46.—Capsule subglobose. 47.

Capsule elongated. 48.

47.—Branches not fascicled; synoicous or monoicous. Bartramia.

Branches fascicled; dioicous with male flowers discoid. Philonotis.

48.—Leaves coarsely serrate to middle; autoicous. Orthopyxis.

Leaves serrulate near apex only; dioicous. Gymnocybe.

49.—Seta straight. Meesea.

Seta arcuate at summit. 50.

50.—Cilia appendiculate (in all our species). Bryum.

Cilia not appendiculate. 51.

51.—Leaves lanceolate; leaf-cells narrowly rhombic-hexagonal inclining to linear. Pohlia.

Leaves oblong, ovate to obovate or broader; cells round-hexagonal. Mnium.

## SPHAGNUM Dill. Bog moss. Peat Moss.

All the species of this genus grow in wet boggy places.

1.—Cuticular cells of stem and pendent branches fibrillose as in the large leaf-cells; branch leaves scabrous at the back of apex. 2.

Cuticular cells of stem and branches not fibrillose; branch leaves not scabrous at the back of apex. 3.

2.—Chlorophyllose cells of branch leaves (in cross section) exposed on the inner surface. cymbifolium.

Chlorophyllose cells of branch leaves included. medium.

3.—Branch leaves more or less secund. subsecundum.

Branch leaves equally spreading. 4.

4.—Stem leaves not bordered; branch leaves squarrose. squarrosum.

Stem leaves broadly bordered with narrow cells; branch leaves erect-open. 5.

5.—Branch leaves with very large pores. 6.

Branch leaves with very small pores. 8.

6.—Stem leaves lacerate fringed at apex, with completely reabsorbed cell-membranes in upper part, without fibrils. Girgensohnii.

Stem leaves usually dentate at apex, nowhere with completely reabsorbed cell-membranes. 7.

7.—Branch leaves five-ranked when dry. quinquefarium.

Branch leaves not five-ranked when dry. acutifolium.

8.—Pendent branches concealing the stem; cuticular cells thin and indistinct; cells of border of stem leaves rather short. recurvum.

Pendent branches not concealing the stem; cuticular cells distinct; cells of border of stem leaves narrow and elongated. cuspidatum.

**S. acutifolium** Ehrh. In swampy places everywhere.

The reddish purple form is frequent and is probably *var. purpureum* Schimp.

**S. cuspidatum** Ehrh. Branch Pond, Sunderland, *G.*

**S. cuspidatum Torreyi** (Sulliv.) Braith. Muddy Pond Woods, West Roxbury, Vt., July 15, 1881, *P.*

The stem leaves of Mr. Pringle's specimens are fibrillose above; otherwise they answer to Braithwaite's figure and description with great exactness.

**S. cymbifolium** (Ehrh.) Hedw. Frequent. Monkton and Starksboro, *P*; Mt. Mansfield and Burlington, *G.*

**S. Girgensohnii** Russ. (*S. strictum* Lindb.) Not rare. Mt. Mansfield, *P*; Smuggler's Notch and Burlington, *G.*

**S. medium** Limpr. var. **laeve** Warnst. Near Willoughby Lake, *F.* (Det. Warnstorf.)

**S. quinquefarium** (Braith.) Warnst. (*S. acutifolium quinquefarium* Braith.) Stowe, *B.*

**S. quinquefarium viride** Warnst. Cliffs of Mt. Hor, Willoughby Lake, *F.*

**S. recurvum** (P. Beauv.) R. & W. var. **parvifolium** Warnst. Stowe, Vt., *B.* (Det. Warnstorf.)

**S. squarrosum** Pers. Frequent.

**S. subsecundum** Nees. Colchester, *P.*

## MUSCI ACROCARPI.

Section I. SCHISTOCARPI.

Family I. ANDREAEACEAE.

### ANDREAEA Ehrh.

**A. petrophila** Ehrh. Rocks, summit of Mt. Mansfield, *P.*, *G.*

Section II. STEGOCARPI.

Family II. BUXBAUMIACEAE.

### BUXBAUMIA Haller.

**B. aphylla** L. On the ground near stumps in the woods. Brattleboro, *Fr.*

Family III. GEORGIACEAE.

### GEORGIA Ehrh.

**G. pellucida** (L.) Rabenh. (*Tetraphis pellucida* Hedw.) Very common on decaying wood.

Family IV. POLYTRICHACEAE.

### CATHARINEA Ehrh.

Dioicous; leaves with apex obtuse, densely areolate, margins serrate only in upper half. **angustata.**

Paroicous; leaves with apex acute, more laxly areolate, margins serrate throughout. **undulata.**

**C. angustata** Brid. (*Atrichum angustatum* Br. & Sch.) Cambridge and Charlotte, *P.*; Johnson, *G.*

**C. undulata** (L.) Web. & Mohr. (*Atrichum undulatum* Beauv.) On the ground in moist shady places; very common.

### POGONATUM P. Beauv.

1.—Stems somewhat branched or dendroid; terminal cell of the lamellae ovoid, papillose. 2.

Stems simple or innovations axial; terminal cell of the lamellae rectangular, papillose. **capillare.**

Stem simple, very short; leaves radical; protenema persistent. **tenue.**

2.—Plants dark green; capsules smooth. **alpinum.**

Plants glaucous; capsules papillose. **uringerum.**

P. **alpinum** (L.) Roehl. On the ground in alpine and subalpine regions. Mt. Hor, *F.*; Mt. Mansfield, *P.*; Brookline, *G.*

P. **capillare** (Michx.) Brid. On the bare soil. Mt. Mansfield, *P.*, *G.*

P. **tenue** (Menzies) E. G. Britton. (*P. brevicaule* Brid.) On bare clayey soil; frequent, especially in mountainous regions.

P. **urnigerum** (L.) Beauv. On the ground. Peacham, *Bl.*; Mt. Mansfield, *P.*; Newfane, *G.*

### POLYTRICHUM L. Hair Cap Moss.

| | |
|---|---|
| 1.—Leaves entire with an inflexed margin. | 2. |
| Leaves sharply serrate, plane. | 4. |
| 2.—Leaves long awned; awn rough, hyaline. | piliferum. |
| Leaves short awned; awn smooth, colored. | 3. |
| 3.—Stems short; leaves spreading, recurved; capsule square, prismatic. | juniperinum. |
| Stems tall; leaves erect-open, straight; capsule small, cuboid. | strictum. |
| 4.—Capsule cubical, calyptra covering it to its base. | commune. |
| Capsule tapering into the seta, calyptra shorter. | Ohioense |

P. **commune** L. Common Hair Cap Moss. Abundant everywhere and a great pest in old meadows where it often entirely supplants the grass over large areas.

P. **juniperinum**. Willd. On the ground; not rare. Peacham, *B.*; Newfane, *G.*

P. **Ohioense** R & C. Mt. Mansfield, D. C. Eaton, *P.*, *G.*

This is the plant from the Eastern United States which has usually been referred to *P. formosum* Hedw.

P. **piliferum** Schreb. In dry open places; frequent.

P. **strictum** Banks. Abundant in boggy places near the summit of Mt. Mansfield and probably on all the higher mountains.

## Family V. Fissidentaceae.

### FISSIDENS Hedw.

| | |
|---|---|
| 1.—Plants terrestrial or submersed but not floating. | 2. |
| Plants aquatic, filiform, floating. | Julianus. |
| 2.—Fruit terminal. | 3. |
| Fruit lateral. | 4. |
| 3.—Leaves not bordered. | osmundioides. |
| Leaves bordered. | bryoides. |
| 4.—Autoicous; leaf cells distinct. | adiantoides. |
| Dioicous; leaf cells obscure. | cristatus. |

F. **adiantoides** (L.) Hedw. On rocks and soil in wet or swampy places. Hinesburgh, *P.;* Willoughby Lake region, *F.*; Salisbury, Eggleston.

F. **bryoides** (L.) Hedw. On the ground and shaded rocks. Brattleboro, *F.*; Smuggler's Notch, *P.*

F. **cristatus** Wils. (*F. decipiens* De Not.) On rocks, soil and decaying wood in swamps or wet places; common.

F. **Julianus** (Savi) Sch. (*Conomitrium Julianum* Mont.) Connecticut River, near Brattleboro, *F.*

F. **osmundoides** (Swtz.) Hedw. On the ground; in swamps and on wet rocks. Willoughby Lake and Starksboro, *P.;* Outlet of Lake of Clouds, Mt. Mansfield, *G.;* near Joe's pond, W. Danville, *Bl.;* Mt. Hor, *F.*

Family VI. LEUCOBRYACEAE.

LEUCOBRYUM Hampe.

L. **glaucum** (L.) Sch. (*L. vulgare* Hampe.) In dense whitish cushions on the ground in woods and moist places; common.

Family VII. DICRANACEAE.

ANISOTHECIUM Mitt.

A. **rubrum** (Huds.) Lindb. (*Discranella varia,* Schimp.) Damp soil and rocks. Brattleboro, *Fr.;* Mt. Mansfield, *P. & G.;* Peacham, *Bl.*

BLINDIA Br. & Sch.

B. **acuta** (Huds.) Br. & Sch. Willoughby Lake and foot of Mt. Hor cliffs, *F.*

CERATODON Brid.

C. **purpureus** (L.) Brid. On soil, rocks, banks, etc.; common and variable.

DICHODONTIUM Sch.

D. **pellucidum** (L.) Sch. var. **Americanum** Lesq. Brattleboro, *Fr.; Vide.* Lesq. & James, Mosses of N. A. 62.

DICRANELLA. Schimp.

D. **heteromalla** (Dill. L.) Sch. Moist banks and rocks, especially in mountain regions. Vide Bull. Torr. Club. **22**: 450. 1895.

D. **heteromalla orthocarpa** Hedw. Mt. Mansfield, *P.*

## DICRANUM Hedw.

| | |
|---|---|
| 1.—Capsule erect, symmetric. | 7. |
| Capsule cernuous, arcuate. | 2. |
| 2.—Leaf cells pitted. | 3. |
| Leaf cells not pitted or only faintly so. | 5. |
| 3.—Leaves mostly transversely undulate. | 4. |
| Leaves not undulate. | 6. |
| 4.—Upper leaf cells elongated; capsules clustered. | undulatum. |
| Upper leaf cells isodiametric; capsules solitary. | Bergii. |
| 5.—Leaves little or not at all secund, strongly crispate when dry, upper cells irregular. | Mulenbeckii. |
| Leaves secund, not crispate, upper cells regular. | fuscescens. |
| 6.—Tufts loose; longitudinal lamellæ ot back of costa dentate. | scoparium. |
| Tufts compact; costa dentate at summit, without lamellæ. | Muhlenbeckii. |
| 7.—Margin of leaves entire, apex usually broken. | viride. |
| Margin serrate or at least denticulate near apex. | 8. |
| 8.—Costa excurrent. | 10. |
| Costa vanishing at the serrulate apex. | 9. |
| 9.—Subulate apex short, papillose at back. | montanum. |
| Subulate apex elongated, smooth at back. | flagellare. |
| 10.—Leaves erect or subsecund, crispate when dry. | fulvum. |
| Leaves falcate-secund, not crispate when dry. | 11. |
| 11.—Costa ⅓ width of base; leaves gradually narrowed into a subulate point. | Sauteri. |
| Costa ⅓ width of base; leaves suddenly narrowed into a very long setaceous point. | longifolium. |

D. **Bergii** Bland. Peacham, *Bl.*

D. **flagellare** Hedw. Rotting wood in shady places; not uncommon.

D. **fulvum** Hook. On rocks in shady places. Manchester, *G.;* Stowe, *B.*

D. **fuscescens** Turn. On rocks and decayed wood in moist places; frequent in mountainous regions.

D. **longifolium** Ehrh. Devil Hill, *Bl.;* Mt. Mansfield, *B.;* Willoughby Mt. and Jay Peak, *F.*

D. **longifolium subalpinum** Milde. Bare rocks on the "Nose" of Mt. Mansfield, *G.* (Det. R. H. True.) The only known locality in the New World.

D. **montanum** Hedw. Carriage road, Mt. Mansfield, *F.*

D. **Muhlenbeckii** Br. & Sch. Rock Point, Burlington, Eggleston. Det. Prof. R. H. True. The Vermont specimens occasionally mature two capsules from one perichætium.

D. **Sauteri** Br. & Sch. Mt. Mansfield, *B.*

D. **scoparium** (L.) Hedw. Shaded banks, rocks and roots of trees; common.

D. **undulatum** Ehrh. On the ground in moist or swampy places. Colchester, Bristol Bog and Monkton, *P.;* Castleton, *G.;* Barnet, *Bl.;* Mt. Hor. and Willoughby Mt., *F.*

D. **viride** (Sull. & Lesq.) Lindb. Mt. Mansfield, D. C. Eaton; specimen in Frost Herb. at Brattleboro. Stowe and Mt. Mansfield, *B.*

DITRICHUM Timm.

| | |
|---|---|
| Monoicous; seta yellow; costa long excurrent. | **pallidum.** |
| Dioicous; seta red; costa subexcurrent. | **tortile.** |

D. **pallidum** (Schreb.) Hampe. (*Leptotrichum pallidum,* Hampe.) Brattleboro, *Fr.*

D. **tortile** (Schrad.) Hampe. (*Leptotrichum tortile,* Muell.) Dry soil; frequent.

ONCOPHORUS Brid.

| | |
|---|---|
| Capsule strumose. | **Wahlenbergii.** |
| Capsule not strumose. | **gracilescens.** |

O. **gracilescens.** (Web. & Mohr.) Lindb. (*Cynodantium gracilescens* Sch.) Mt. Mansfield summit, *G. & P.*

O. **gracilescens alpestre** Schimp. Mt. Mansfield, *P.*

O. **Wahlenbergii** Brid. (*Cynodantium virens var. Wahlenbergii* Br. & Sch.) Stowe, *B.;* Mt. Hor & Willoughby Lake, *F.*

SAELANIA, Lindb.

S. **caesia** (Vill.) Lindb. (*Leptotrichum glaucescens* Hampe.) Very dry hills. Peacham, *Bl.*; Brattleboro, *Fr.*; Willoughby, Dr. Kennedy.

SELIGERIA Br. & Sch.

S. **calcarea** (Dicks.) Br. & Sch. Slides, Willoughby Mt., Dr. Geo. G. Kennedy. In herb. U. V. M.

SWARTZIA Ehrh.

S. **montana** (Lamk.) Lindb. (*Distichium capillaceum* Br. & Sch.) Wet crevices of rocks in mountains. Cliffs of Willoughby Mt., *F.;* Mt. Mansfield, *P.*

TREMATODON Mx.

T. **ambiguus** (Hedw) Hornsch. Willoughby Lake, *F.;* Brattleboro, *Fr.* In herb. Frost as *T. longicollis* Mx.

## Family VIII. Tortulaceae.

### BARBULA Hedw.

| | |
|---|---|
| 1.—Peristome lacking. | curvirostris. |
| Peristome present. | 2. |
| 2.—Peristome short, erect. | rubella. |
| Peristome elongated, contorted | 3. |
| 3.—Leaves squarrose-recurved. | fallax |
| Leaves erect-open. | 4. |
| 4—Leaves with costa vanishing at or below apex. | convoluta. |
| Leaves mucronate with the excurrent costa. | unguiculata. |

B. **convoluta** Hedw. Brattleboro, *Fr.*

B. **curvirostris** (Ehrh.) Lindb. (*Gymnostomum curvirostrum* Hedw.) Calcareous alpine cliffs. Willoughby cliffs, *F.;* Smugglers' Notch, and cliffs of L. Champlain, *P.*

B. **fallax** Hedw. Shaded rocks, Winooski River, *P.*

B. **fallax brevifolia** (Sm.) Schultz. Brattleboro, *Fr.*

B. **rubella** (Hoffm.) Mitt. (*Didymodon rubellus* Br. & Sch.) Roadside Willoughby Lake, and Williamstown Gulf, *F.* Limestone cave east of High Bridge, Burlington, and Dorset Mt. *G.*; Peacham, *Bl.*; N. Pomfret, *Fr.*

B. **unguiculata** (Huds.) Hedw. On dry soil and rocks. Manchester, *G.;* Peacham, *Bl.*; Newport, *F.*; Brattleboro, *Fr.*

### LEERSIA Hedw.

| | |
|---|---|
| Costa excurrent. | laciniata. |
| Costa vanishing at apex. | contorta. |

L. **contorta** (Wulf.) Lindb. (*Encalypta streptocarpa* Hedw.) Limeston cave east of High Bridge, Burlington, *G.*

L. **laciniata** Hedw. (*Encalypta ciliata* Hedw.) On rocks in subalpine regions. Peacham, *Bl.* and *P.*; Willoughby, Mt., and Mt. Hor, *F.*; N. Pomfret and Brattleboro, *Fr.*

### MOLLIA Schrank.

| | |
|---|---|
| 1.—Costa excurrent. | 2. |
| Costa vanishing in or below apex. | 5. |
| 2.—Plants small nearly simple. | viridula. |
| Plants larger, robust, branched or divided. | 3. |

3.—Leaves long linear, acute, abruptly mucronate. humilis.

Leaves very long acuminate, cuspidate. 4.

4.—Leaves twisted crispate when dry, of one layer of cells above. tortuosa.

Leaves not crispate, of two layers of cells above. fragilis.

5.—Capsule oval; annulus lacking. aeruginosa.

Capsule cylindric; annulus of two rows of narrow cells. tenuirostris.

M. **aeruginosa** (Sm.) Lindb. (*Gymnostomum rupestre* Sch.) Cliffs of L. Champlain, *P.*; Rock Point, Burlington, *G.*; Brattleboro, *Fr.* Base of Mt. Hor Cliffs, *F.*

M. **fragilis** (Drumm.) Lindb. (*Barbula fragilis*, Br. & Sch.) Mt. Mansfield, *F.*

M. **humulis** (Hedw.) Braith. (*Barbula caespitosa* Schwaegr.) Brattleboro, *Fr.*; Swamps, Charlotte, *P.*

M. **tenuirostris** (Hook and Tayl.) Lindb. (*Didymodon cylindricus* Br. & Sch.) Rock Point, Burlington, *G.*

M. **tortuosa** (L) Schrk. (*Barbula tortuosa* Web. & Mohr.) Rocks and banks. Peacham, *Bl.*; Mt. Mansfield summit and Willoughby Lake region, *F.*

M. **viridula** (L) Lindb. (*Weissia viridula* Brid.) On the ground under various conditions. Mt. Mansfield, *B.*; Hinesburgh, *P.*; Peacham, *Bl.*; Brattleboro, *Fr.*

POTTIA Ehrh.

P. **truncatula** (L) Lindb. (*P. truncata* Fuern.) On the ground in a pasture. Brattleboro. *Fr.*; Burlington, L. R. Jones.

TORTULA Hedw.

T. **mucronifolia** Schwaegr. Shelburne Point, *P.*

Family IX. WEBERACEAE.

WEBERA Ehrh.

W. **sessilis** (Schmid.) Lindb. (*Diphyscium foliosum* Mohr.) Moist rocks and banks; frequent in mountainous regions.

Family X. GRIMMIACEAE.

ANOECTANGIUM Hedw.

A. **Lapponicum** Hedw. (*Amphoridium Lapponicum* Schimp.) Fissures of rocks. Mt. Mansfield, *P.*

## DRUMMONDIA Hook.

D. **prorepens** (Hedw.) E. G. Britton. (*D. clavellata* Hook.) Trunks of trees, frequent.

## GRIMMIA Ehrh.

1.—Capsule immersed. 2.

Capsule exserted. 3.

2.—Leaf margins plane. Donii.

Leaf margins revolute. apocarpa.

3.—Leaves ending in a whitish hair. 4.

Leaves not ending in whitish hair. 7.

4.—Seta arcuate. Olneyi.

Seta straight. 5.

5.—Areolation sinuose, nodulose-linear throughout. ramulosa.

Areolation roundish quadrate above. 6.

6.—Autoicous; very short, densely pulvinate; capsule pale. Donii.

Dioicous; taller, laxly tufted; capsule brown. microcarpa.

7.—Leaf cells all elongated and sinuose. fascicularis.

Upper leaf-cells (at least near apex) quadrate to roundish. 8.

8.—Leaves narrowly linear-lingulate from an ovate-oblong entire base; lower leaf cells rectangular to quadrate. unicolor.

Leaves broadly ovate-oblong, usually remotely hyaline-dentate above, lower leaf cells linear, sinuose. acicularis.

G. **acicularis** (L.) C. Muell. (*Racomitrium acicularis* Brid.) Rocks by brooks. Mt. Mansfield, *P.*

G. **apocarpa** (L.) Hedw. On rocks, not rare. Smuggler's Notch, *P.;* Johnson, *G.;* Brattleboro, *Fr.;* Willoughby Lake, *F.*

G. **Donii** Smith. var. **sudetica** (Spreng.) Braith. Old stone walls, Brattleboro, *Fr.*

G. **fascicularis** (Schrad.) C. Muell. (*Racomitrium fasciculare* Brid.) Mt. Mansfield, *P. & G.*

G. **microcarpa** (Gmel.) Lindb. (*Racomitrium sudeticum* Brid.) Moist alpine rocks. Mt. Mansfield, *P.*

G. **Olneyi** Sulliv. On rocks near the Connecticut River, *Fr.*

G. **ramulosa** Lindb. (*Racomitrium microcarpum* Brid.) On rocks at summit of Mt. Mansfield, *P. & G.*

G. **unicolor** Hook. Dry rocks, Rock Point, Burlington, *G.*

## HEDWIGIA Ehrh.

H. **albicans** (Web.) Lindb. (*H. ciliata* Ehrh.) Common on exposed ledges.

**H. albicans leucophea** Schimp. Willoughby Mt., *F.*

**H. albicans viridis** Br. & Sch. E. Barnet, *Bl.;* Bluffs of Lake Champlain, Burlington, *G.*

ORTHOTRICHUM Hedw.

1.—Capsule long exserted. **anomalum.**
Capsule immersed or half emergent. 2.
2.—Leaves obtuse. **Ohioense.**
Leaves acute. **strangulatum.**

**O. anomalum** Hedw. Limestone cliffs of Lake Champlain and Willoughby Mt., *F.;* Jonesville, *B.*

**O. Ohioense** Sull. & Lesq. On trees. Charlotte, *P.*

**O. strangulatum** Beauv. On trees. Brattleboro, *Fr.*

WEISSIA Ehrh.

1.—Leaves rigid, not crisped. **Americana.**
Leaves crisped when dry. 2.
2.—Capsule striate only at the contracted orifice. **coarctata.**
Capsule striate all its length. **ulophylla.**

**W. Americana** (Beauv.) Lindb. (*Ulota Hutchinsiae* Schimp.) On rocks in subalpine regions; not uncommon. Manchester, *G.;* Smuggler's Notch, Mt. Mansfield, *B.;* Brattleboro, *Fr.*

**W. coarctata** (Beauv.) Lindb. (*Ulota Ludwigii* Brid.) Trunks of trees; frequent. Peacham, *Bl.;* Underhill and Mt. Mansfield, *P.;* Newfane, *G.;* Stowe, *B.;* Brattleboro, *Fr.*

**W. ulophylla** Ehrh. (*Ulota crispa* Brid.) On trees; not rare in subalpine regions. Newfane, Manchester, *G.;* Peacham, *Bl.;* Underhill, *P.;* Brattleboro, *Fr.*

**W. ulophylla crispula** (Bruch.) Hammar. (*Ulota crispula* Brid.) Willoughby Mt., *F.;* Underhill Notch, *G.*

Family XI. SCHISTOSTEGACEAE.

SCHISTOSTEGA Mohr.

**S. osmundacea** (Dicks.) Mohr. Path up Jay Peak, *F.* In herb. Faxon.

Family XII. SPLACHNACEAE.

TAYLORIA Hook.

**T. tenuis** (Dicks.) Schimp. On cow dung in swamp at the top of Mt. Mansfield, Dr. Geo. G. Kennedy. In herb. U. V. M.

### TETRAPLODON Br. & Sch.

T. **bryoides** (Zoega) Lindb. (*Tetraplodon mnioides* Br. & Sch.) Bones of hedgehog, Mt. Mansfield summit, *G.*

## Family XIII. Funariaceae.

### FUNARIA Schreb.

F. **hygrometrica** (L.) Sibth. On the ground, common.

### PHYSCOMITRIUM Brid.

P. **pyriforme** (L.) Brid. On soil, Brattleboro, *Fr.*

## Family XIV. Bryaceae.

### BRYUM. Dill.

| | |
|---|---|
| 1.—Costa excurrent. | 2. |
| Costa ending in or below apex. | 5. |
| 2.—Leaves bordered. | 3. |
| Leaves not bordered. | 4. |
| 3.—Autoicous. | pallescens. |
| Synoicous. | bimum. |
| Dioicous; capsule long necked. | pallens. |
| 4.—Synoicous. | intermedium. |
| Dioicous. | caespiticium. |
| 5.—With stolons; leaves large, clustered at summit. | proliferum. |
| Without stolons; leaves scattered. | 6. |
| 6.—Costa extending to apex. | concinnatum. |
| Costa ending below apex. | 7. |
| 7.—Leaves distant. | Duvalii. |
| Leaves closely imbricated. | argenteum. |

B. **argenteum** L. Waste ground, in walks and on walls and rocks; common.

B. **bimum** Schreb. Spring opposite Notch House, Smugglers Notch, *B.;* Brattleboro, *Fr.;* swamps, Charlotte, *P.;* Peacham, *Bl.;* brooks in Willoughby Lake region, *F.;* wet cliffs, Castleton, *G.*

B. **caespiticium** L. Rocks and dry banks; frequent.

B. **concinnatum** Spruce. Mansfield Pass, *P.*. (Det. Lindberg.)

B. **Duvalii** Voit. Rivulets in meadows, Willoughby, *F.*

B. **intermedium** Brid. Shady ground and crevices of rocks. Willoughby Lake region, *F.*

B. **pallens** Swtz. Willoughby Cliffs and Williamstown Gulf, *F.*

B. **pallescens** Schleich. Cliffs of Mt. Mansfield, *P.*

B. **proliferum** (L.) Sibth. (*Bryum roseum* Schreb.) On decaying wood and rich earth in moist shady places; common.

### LEPTOBRYUM Wils.

L. **pyriform** (L.) Wils. Mt. Mansfield, *P.;* Williamstown Gulf, *F.;* Brattleboro, *Fr.*

### POHLIA Hedw.

1.—Upper leaves suddenly elongated; neck of capsule equaling sporangium; cilia none or rudimentary. **elongata.**

Upper leaves broader; neck of capsule shorter than sporangium; cilia well developed. 2.

2.—Annulus lacking; dioicous. **albicans.**

Annulus present. 3.

3.—Tufts 2-4 cm. high; basal membrane of endostome ⅓-½ height of teeth; paroicous. **nutans.**

Tufts 1-2 cm. high; basal membrane ¼ height of teeth; polyoicous. **cruda.**

P. **albicans** (Wahlenb.) Lindb. (*Webera albicans* Sch.) In border of pool, Milton Falls, *G.;* Springy places, Brattleboro, *Fr.;* Jay Peak, *F.*

P. **cruda** (L.) Lindb. (*Webera cruda* Sch.) Mt. Hor, *F.;* Brattleboro, *Fr.*

P. **elongata** Hedw. (*Webera elongata* Schwaegr.) Mt. Mansfield, *P.* and *G.;* Jay Peak, *F.*

P. **nutans** (Schreb.) Lindb. (*Webera nutans* Hedw.) Moist rocky banks and crevices of rocks in mountaius. Johnson, *G.;* Mt. Mansfield and Charlotte, *P.;* Jay Peak and Willoughby Lake region, *F.;* Brattleboro, *Fr.*

Family XV. BARTRAMIACEAE.

### BARTRAMIA Hedw.

Leaves smooth. **Oederi.**

Leaves papillose. **pomiformis.**

B. **Oederi** (Gunn.) Swtz. (*B. Oederiana* Swtz.) Wet shady banks in cold or mountainous regions. Manchester, *G.;* Hinesburgh and Cliffs of Mt. Mansfield, *P.;* Mt. Hor, *F.;* Woodstock, Miss C. G. Soule.

B. **pomiformis** (L.) Hedw. Wet shady banks and fissures of rocks. Manchester, *G.;* Peacham, *Bl.;* Mt. Hor, *F.;* Hinesburgh, *P.;* Woodstock, Miss Soule.

### PHILONOTIS Brid.

P. **fontana** (L.) Brid. Wet rocks; frequent.

A careful study of all accessible material indicates that the Vermont specimens of Philonotis are all *P. fontana.*

Family XVI. MEESEACEAE.

### MEESEA Hedw.

M. **triquetra** (L.) Aongst. (*M. tristicha* Br. & Sch.) Shelburne Pond Bog, *P.*

Family XVII. MNIACEAE.

### GYMNOCYBE Fries.

G. **palustris** (L.) Fries. (*Aulacomnium palustre* Schwaegr.) Cool, boggy places; frequent but rarely fruiting.

### MNIUM Dill. L.

| | |
|---|---|
| 1.—Leaves not bordered | **stellare.** |
| Leaves bordered. | 2. |
| 2.—Margin biserrate. | 4. |
| Margin serrate with solitary teeth. | 8. |
| Margin entire. | 3. |
| 3.—Leaves costate to apex, upper leaf cells longer than broad. | **punctatum.** |
| Costa vanishing, upper leaf cells isodiametric. | **hymenophylloides.** |
| 4.—Costa vanishing below apex. | **hornum.** |
| Costa reaching apex. | 5. |
| 5.—Capsules clustered. | **spinulosum.** |
| Capsules solitary. | 6. |
| 6.—Synoicous. | **marginatum.** |
| Dioicous. | 7. |
| 7.—Costa excurrent in upper leaves; leaf cells .018—.030 mm. | **pseudolycopodoides.** |
| Costa percurrent; leaf cells about .015 mm. | **orthorhynchum.** |
| 8.—Basilar branches stoloniform. | 9. |
| Basilar branches erect or stems simple. | **Drummondii.** |
| 9.—Leaves rounded at apex, mucronate; operculum rostrate. | **rostratum.** |
| Leaves acuminate. | 10. |

| | |
|---|---|
| 10.—Leaves serrate to middle. | sylvaticum. |
| Leaves serrate to base. | 11. |
| 11. - Leaves slightly decurrent, obovate-oblong. | cuspidatum. |
| Leaves very long decurrent, oblong. | ciliare. |

**M. cuspidatum** (L.) Neck. (Non Hedwig.) (*Mnium affine* Bland.) On decaying wood, Peacham, *Bl.;* on soil, Mt. Mansfield, *G.;* Brattleboro, *Fr.;* Willoughby Lake, *F*,

**M. ciliare** (Grev.) Lindb. Cold Brook, Willoughby, *F.* (Det. E. G. Britton.

**M. Drummondii** Br. & Sch. Near Willoughby Lake, *F.;* Woodstock, Miss Soule.

**M. hymenophylloides** Hueben. Base of Mt. Hor Cliffs, *F.*

**M. hornum**, L. Brattleboro, *Fr.*

**M. marginatum** (Dicks.) Beauv. (*M. serratum* Laich.) Rock Point, Burlington, *G.;* Mt. Hor, *F.;* Smuggler's Notch, Eggleston.

**M. orthorrhynchum** Br. & Sch. On the ground and in wet places. Mt. Mansfield region and Monkton, *P.;* Mt. Hor, *F.*

**M. pseudolycopodioides** C. M. & Kindb. (M. *lycopodioides.* L. & J. non Schwaegr.) Mt. Hor, *F.*

**M. punctatum** L. var. **elatum** Schimp. On the ground in cool wet places; frequent. Belden Pond, Johnson, *G.;* Brattleboro, *Fr.*

**M. rostratum** Schrad. Woodland rivulets. Brattleboro, *Fr.*

**M. spinulosum** Br. & Sch. Woods, Peacham, *Bl.;* Rock Point, Burlington, *G.*

**M. stellare** Reich. On the ground and rotting wood in moist shady places. Hinesburgh, *P.;* Peacham, *Bl.;* Mt. Hor and Williamstown Gulf, *F.;* Brattleboro, *Fr.*

**M. sylvaticum** Lindb. (*M. cuspidatum* Hedw.) On rocks, soil and roots of trees; in wet shady places. Monkton and Burlington, *P.;* Peacham, *Bl.;* Mt. Hor and Willoughby, *F.;* Newfane, *G.;* Brattleboro, *Fr.*

## ORTHOPYXIS P. Beauv.

**O. heterosticha** (Hedw.) P. Beauv. (*Aulacomnium heterostichum.* Br. & Sch.) Base of trees in moist woods, Newfane, Manchester, *G.;* Brattleboro, *Fr.*

## MUSCI PLEUROCARPI.

| | |
|---|---|
| 1.—Internal peristome latticed; aquatic. | Fontinalis. |
| Internal peristome not latticed. | 2. |
| 2.—Leaves strongly papillose. | 25. |
| Leaves not papillose or very slightly so by reason of the thickening of angles of the cell walls. | 3. |
| 3.—Peristome single. | 4. |
| Peristome double, the inner often imperfect. | 6. |
| 4.—Leaves distichous, lamina with an extra division at base. | Fissidens. |
| Leaves pluriseriate. | 5. |
| 5.—Leaves ecostate. | Leucodon. |
| Leaves costate. | Leptodon. |
| 6.—Segments short or none or obscured by adhering to the teeth. | 7. |
| Segments narrowly linear, often indistinctly keeled. | 10. |
| Segments lanceolate, distinctly keeled. | 11. |
| 7.—Capsules straight. | 8. |
| Capsules more or less curved. | Homalothecium |
| 8.—Segments adherent to the teeth. | 9. |
| Segments not adherent to the teeth. | Neckera. |
| 9.—Leaves costate. | Homalothecium. |
| Leaves ecostate or costa short and double. | Pylaisiella. |
| 10.—Leaves costate, costa single. | Anacamptodon. |
| Leaves ecostate or costa short and double. | Entodon. |
| 11.—Capsule symmetric, erect. | 12. |
| Capsule unsymmetric, often arcuate, more or less inclined. | 14. |
| 12.—Costa single, extending to the middle or beyond. | 13. |
| Costa short and double or none. | Entodon. |
| 13.—Plants dendroid. | Climacium. |
| Plants not dendroid, creeping; leaves complanate, pseudodistichous. | Homalia. |
| 14.—*Leaf cells short 1:3 or less. | 15. |
| Leaf cells 1:3 or more. | 16. |
| 15.—Plants stout, dendroid; leaves coarsely serrate. | Porotrichum. |
| Plants slender, creeping; leaves entire or denticulate above. | Amblystegium. |
| 16.—Costa single, extending to middle of leaf. | 17. |
| Costa short and double or none. | 22. |
| 17.—Operculum long-rostrate. | 18. |
| Operculum conic or very short-rostrate. | 19. |
| 18.—Stem leaves deltoid or else papillose by the thickened angles of the cell walls. | Eurhynchium. |

**Brachythecium reflexum* will be sought here.

Stem leaves ovate or ovate-lanceolate, smooth. **Rhynchostegium.**

Stem and branch leaves very concave, spoon-shaped. **Myuroclada.**

19.—Leaves not secund or obtuse. 20.

Leaves secund or obtuse. **Hypnum.**

20.—Capsule short, erect to horizontal, usually somewhat arcuate and contracted under the mouth when dry. 21.

Capsule longer, very strongly arcuate and contracted under the mouth when dry. **Amblystegium.**

21.—Leaves deeply plicate lengthwise; stems often covered with felted radicles; plants a bright glossy yellow-green. **Camptothecium.**

Leaves little or not at all plicate; stems not covered with felted radicles; plants less glossy. **Brachythecium.**

22.—Leaves secund. **Hypnum.**

Leaves complanate. **Plagiothecium.**

Leaves equally spreading. 23.

23.—Lid long subulate-rostrate. **Raphidostegium.**

Lid conic or short-rostrate. 24.

24.—Plants small and slender. **Amblystegium.**

Plants large and robust. **Hylocomium and Hypnum.**

25.—Peristome double but segments none or short. 26.

Peristome double, segments narrowly linear, indistinctly keeled. 28.

Peristome double, segments lanceolate, distinctly keeled. 29.

26.—Leaves entire, ovate to ovate-lanceolate. 27.

Leaves spinulose-dentate to fimbriate, deltoid or round ovate. **Thelia.**

27.—Teeth of peristome ciliate papillose. **Leskea.**

Teeth of peristome not ciliate papillose. **Anomodon.**

28.—Stem and branch leaves similar. **Leskea.**

Stem leaves much smaller than branch leaves. **Anomodon.**

29.—Capsule symmetric, erect. **Myurella.**

Capsule unsymmetric, arcuate. **Thuidium.**

## Family XVIII. Leskeaceae.

### ANOMODON Hook and Taylor.

1.—Base of leaves with large fimbriate-papillose auricles. **apiculatus.**

Base of leaves not auriculate. 2.

2.—Leaves filiform-acuminate. **rostratus**

Leaves obtuse or apiculate. 3.

3.—Branches attenuate. **attenuatus.**

Branches not attenuate. 4.

4.—Leaves open-erect, teeth nodose. **obtusifolius.**

Leaves secund, teeth not nodose. **viticulosus.**

A. **apiculatus** Br. & Sch. Base of trees, in moist woods; frequent.

A. **attenuatus** (Schreb.) Hüben. On rocks and base of trees; common, but rarely fruiting.

A. **minor** (P. Beauv.) Fuern. *A. obtusifolius* (Br. & Sch.) On trunks of trees. Johnson and Manchester, *G.*; Willoughby Cliffs and Charlotte, *P.*; Willoughby Mt. and Ferrisburgh, *F.*

A. **rostratus** (Hedw.) Schimp. On the ground and stones and around the roots of trees in wet places; common.

A. **viticulosus** (L.) Hook & Tayl. Limestone cave east of High Bridge, Burlington, *G.*; Brattleboro, *Fr.*

### HETEROCLADIUM Br. & Sch.

H. **squarrosulum** (Voit) Lindb. (*H. dimorphum*, Brid.) Dry shaded rocks. Brattleboro, *Fr.*

### LESKEA Hedw.

| | |
|---|---|
| 1.—Costa percurrent. | **nervosa.** |
| Costa not percurrent. | 2. |
| 2.—Leaves bluntish; segments cleft between the articulations. | **obscura.** |
| Leaves acute, segments not cleft. | **polycarpa.** |

L. **nervosa** (Schwaegr.) Myrin. Trunks of trees. Smugglêrs Notch, *P.*; Mt. Hor, *F.*

L. **obscura** Hedw. Brattleboro, *Fr.*; Little Otter Creek, Ferrisburgh, Lewis Creek and Willoughby Mt., *F.*

L. **polycarpa** Ehrh. Roots and trunks of trees, Cambridge, *P.*

### MYURELLA Br. & Sch.

| | |
|---|---|
| Leaves serrulate, obtuse or rarely short apiculate. | **julacea.** |
| Leaves spinulose-dentate, abruptly long acuminate. | **Careyana.** |

M. **Careyana** Sull. Limestone cave east of High Bridge, Burlington, *G.*; Brattleboro, *Fr.*; Smuggler's Notch, Eggleston; Williamstown Gulf, Willoughby Mt., and Mt. Hor, *F.*; Limestone ledges, Dorset Mt. *G.*

M. **julacea** (Vill.) Br. & Sch. Cliffs of Mt. Sterling, *B.*; Cliffs of Mt. Mansfield, Mt. Hor, and Willoughby Mt., *F.*

### THELIA Sulliv.

| | |
|---|---|
| Papillae of leaves simple. | **hirtella.** |
| Papillae of leaves 2-4-furcate. | **asprella.** |

T. **asprella** (Schimp.) Sulliv. Roots and stumps of trees, Brattleboro, *Fr.*

T. **hirtella** (Hedw.) Sulliv. Roots and trunks of trees, Brattleboro, *Fr.*

## THUIDIUM Br. & Sch.

| | |
|---|---|
| 1.—Plants large (to 10 cm.), ascending, erect, 1-pinnate. | 3. |
| Plants large (to 10 cm), creeping, 2-3-pinnate. | 2. |
| Plants small (to 5 cm), creeping, 1 pinnate. | scitum. |
| 2.—Stem leaves spreading-recurved, margins plane; perichaetium not ciliate. | recognitum. |
| Stem leaves erect-spreading, margins recurved; perichaetium ciliate. | delicatulum. |
| 3.—Leaf cells roundish or oblong 2-1:1. | abietinum. |
| Leaf cells long-rhombic to linear, 3-6:1. | 4. |
| 4.—Stem leaves soft, subclasping, decurrent. | Blandovii. |
| Stem leaves rigid, plicate-striate, subdecurrent. | paludosum. |

T. **abietinum** (L.) Br. & Sch. Growing in short grass, seldom or never fruiting. Abundant on dry soil near Burlington, especially near Twin Bridges, *G.;* Willoughby Mt., *F.;* Smuggler's Notch, *B.;* Fairhaven, Eggleston.

T. **Blandovii** (W. & M.) Br. & Sch. Wet meadow, Willoughby Lake, *F.*; Peacham, *Bl.*

T. **delicatulum** (L.) Mitt. On the ground, rotten wood, stones and rocks in shady places; common.

T. **paludosum** (Sulliv.) Rau & Hervey. Swamps. Brattleboro, *Fr.* (Det. Sullivant.)

T. **recognitum** (Hedw.) Lindb. In habit similar to *T. delicatulum* with which it is often confused. Distinguished by its spreading, recurved leaves with their long-celled thickened acumen. Frequent.

T. **scitum** (Beauv.) Aust. Brattleboro, *Fr.;* Fairhaven, Eggleston.

T. **scitum aestivale** Austin. Base of trees, Johnson, *G.;* Monkton, *P.;* Peacham, *Bl.* Vide Bull. Torr. Club **23**:83. 1886.

Family XIX. HYPNACEAE.

## AMBLYSTEGIUM Br. and Sch.

| | |
|---|---|
| 1.—Leaves with a distinct border of narrow incrassate cells. | Lescurii. |
| Leaves not bordered. | 2. |
| 2.—Leaves ecostate or with obscure traces of a costa, | 3. |
| Leaves costate. | 6, |
| 3.—Leaves open-erect to appressed-imbricate. | 4. |
| Leaves spreading, squarrose. | 5. |
| 4.—Plants minute, filiform (1-2 cm.) | confervoides. |
| Plants larger, in wide flat tufts. | adnatum. |
| 5.—Alar cells abruptly enlarged, often inflated and colored. | stellatum. |
| Alar cells scarcely different or quadrate or rectangular. | hispidulum. |

| | |
|---|---|
| 6.—Costa extending to apex. | 7. |
| Costa ending below apex. | 9. |
| 7.—Leaves acuminate. | 8. |
| Leaves not acuminate, ovate to oblong-lanceolate. | fluviatile. |
| 8.—Basal cells abruptly enlarged. | irriguum. |
| Basal cells not enlarged. | varium. |
| 9.—Leaves reflexed-squarrulose. | chrysophyllum. |
| Leaves open-erect. | 10. |
| 10.—Cells near middle of leaf 10-15:1. | riparium. |
| Cells near middle of leaf less than 8:1. | serpens. |

A. **adnatum** (Hedw.) Jaeger & Sauerb. On rocks and base of trees in shady places. Springfield, Johnson, *G.;* Hinesburgh, *P.;* Peacham, *Bl.;* Brattleboro, *Fr.*

A. **chrysophyllum** (Brid.) De Not. On stones and base of trees in moist places. Monkton, *P.;* Brattleboro, *Fr.;* Burlington and Manchester, *G.;* Waverly Cascades, *B.*

A. **confervoides** (Brid.) Br. & Sch. Swamps, Charlotte, *P.;* Rattling Brook, Willoughby, *F.*

A. **fluviatile** (Swtz.) Br. & Sch. On rocks in cold brooks. Mt. Mansfield and Charlotte, *P.*

A. **hispidulum** (Brid.) Grout. On dead limbs of trees. Brattleboro, *Fr.;* Roaring Brook, Willoughby Lake, *F.;* Underhill Notch, *G.;* Monkton and Charlotte, *P.*

A. **irriguum** (Hook. & Wils.) Br. & Sch. Rocks in bed of brooks. Peacham, *Bl.;* Williamstown Gulf, *F.;* Brattleboro, *Fr.* In Gray Herbarium as *A. varium* var.

A. **Lescurii** (Sulliv.) Aust. Brattleboro, *Fr.* In the Gray Herbarium. *Vide* Sullivant in Icones Muscorum.

A. **riparium** (L.) Br. & Sch. On stones, roots of trees and rotting wood, in swamps and also growing in water. Charlotte and Monkton, *P.;* Barnet, *Bl.;* Ferrisburgh, *F.*

A. **serpens** (L.) Br. & Sch. On decayed stumps and muddy shores Johnson and Newfane, *G.;* Brattleboro, *Fr.;* Mt. Hor, *F.*

A. **stellatum** (Schreb.) Lindb. Willoughby Cliffs, *F.*

A. **varium** (Hedw.) Lindb. (*A. orthocladon* L. & J., non Beauv.) Owl's Head Mt. and Eagle Cliff, Lake Memphremagog, *F.;* Brattleboro, *Fr.*

## HYLOCOMIUM Br. & Sch.

| | |
|---|---|
| 1.—Paraphyllia lacking. | triquetrum. |
| Paraphyllia present. | 2. |
| 2.—Leaves bicostate. | 3. |
| Leaves unicostate to middle. | Pyrenaicum. |
| 3.—Plants regularly 2-3 pinnate, | proliferum. |
| Plants irregularly or pinnately branching. | 4. |
| 4.—Stem leaves loosely erect. | umbratum. |
| Stem leaves squarrose-spreading. | brevirostre. |

H. **brevirostre** (Ehrh.) Br. & Sch. Shore of Lake Memphremagog near Mountain House, Owl's Head Mt., Canada, *F.*; only a few miles north of the Vermont line and undoubtedly occurs within the State. Reported by Frost but no specimen has been seen.

H. **Pyrenaicum** (Spruce) Lindb. (*H. Oakesii* Sulliv.) Stowe, *P.;* Mt. Hor and Willoughby Mt., *F.*

H. **proliferum** (L.) Lindb. (*H. splendens* Hedw.) On decaying logs, stumps, earth and stones in cool moist woods, especially in mountain regions.

H. **triquetrum** (L.) Br. & Sch. On soil and decaying wood in damp shady places; common.

H. **umbratum** (Ehrh.) Br. & Sch. Abundant on earth and rocks, in mountain woods; seldom fruiting. Mt. Mansfield, *P.;* Stratton Mt., *G.;* Brattleboro, *Fr.;* Mt. Hor, *F.*

## HYPNUM Dill.

| | |
|---|---|
| 1.—Leaves spreading or complanate, not secund. | 2. |
| Leaves secund. | 12. |
| 2.—Costa extending to middle of leaf or beyond. | 3. |
| Costa very short and double or none. | 6. |
| 3.—Leaves acute or acuminate. | palustre. |
| Leaves obtuse, entire. | 4. |
| 4.—Costa subpercurrent. | cordifolium. |
| Costa reaching middle of leaf. | 5. |
| 5.—Branches irregularly pinnate ; leaves spreading. | Richardsoni. |
| Branches few, leaves imbricate. | stramineum. |
| 6.—Alar cells abruptly enlarged (often inflated or colored.) | 7. |
| Alar cells scarcely different or quadrate or rectangular, not abruptly enlarged. | 10. |
| 7.—Operculum short-rostrate. | Haldanianum. |
| Operculum convex or conic. | 8. |

| | |
|---|---|
| 8.—Leaves falcate. | eugyrium. |
| Leaves not falcate. | 9. |
| 9.—Leaves acute or short apiculate, alar cells few, large. | palustre. |
| Leaves obtuse, alar cells hyaline. | cuspidatum. |
| 10.—Plants terrestrial, bright yellow-green. | Schreberi. |
| Plants subaquatic, dark or dirty green. | 11. |
| 11.—Plants very large 10-25 cm. long, dioicous; leaves oblong-ovate. | scorpioides. |
| Plants smaller 5-10 cm.; monoicous; leaves ovate. | molle. |
| 12.—Costa single, reaching the middle or beyond. | 13. |
| Costa short and double or none. | 24. |
| 13.—Leaves transversely rugose. | 14. |
| Leaves not rugose. | 15. |
| 14.—Plants slender. | aduncum gracilescens. |
| Plants very stout. | rugosum. |
| 15.—Paraphyllia abundant. | 16. |
| Paraphyllia none. | 17. |
| 16.—Leaves plicate. | commutatum. |
| Leaves not plicate. | filicinum. |
| 17.—Annulus none. | 18. |
| Annulus present, often large. | 19. |
| 18.—Leaves quite entire, short acuminate. | palustre. |
| Leaves denticulate, subulate acuminate. | fluitans. |
| 19.—Leaves acute or bluntish. | ochraceum. |
| Leaves gradually long acuminate. | 20. |
| 20.—Leaves broad (1—1.5 mm.), crumpled and plicate when dry. | Wilsoni. |
| Leaves narrower (0.5—1 mm.), not crumpled when dry. | 21. |
| 21.—Leaves denticulate. | uncinatum. |
| Leaves entire. | 22. |
| 22.—Leaves auricled. | aduncum. |
| Leaves not auricled. | 23. |
| 23.—Leaves plicate; plants pale green or shining yellow. | vernicosum. |
| Leaves smooth; plants brown, purple, or blackish. | revolvens. |
| 24.—Plants regularly pinnate. | 25. |
| Plants irregularly branched. | 29. |
| 25.—Capsule costate and arcuate when dry. | curvifolium. |
| Capsule not costate. | 26. |
| 26.—Leaves serrate or denticulate all around. | 27. |
| Leaves serrate or denticulate only above the middle. | 28. |

27.—Capsule long-cylindric, sub-erect or slightly incurved. **imponens.**

Capsule ovate, oblong or obovate, inclined or arcuate. **molluscum.**

28.—Stem leaves plicate; plants large (to 15 cm.). **Crista-castrensis.**

Plants small (to 5 cm.); stem leaves not plicate. **fertile.**

29.—Leaves entire. **pratense.**

Leaves serrulate or denticulate above. 30.

30.—Costa double, reaching middle of leaf. **reptile.**

Costa double, short. **cupressiforme.**

H. **aduncum** Hedw. Swampy ground brooks. Shelburne and Charlotte, *P.;* Brattleboro, *Fr.;* Willoughby Lake, *F.*

H. **aduncum gracilescens** Br. & Sch. Wet meadow near Willoughby Lake, *F.*

H. **commutatum** Hedw. Base of southern part of Willoughby Cliff, *F.*

H. **cordifolium** Hedw. New Haven, *F.;* Monkton, Richford and Starksboro, *P.;* Sutton and Willoughby Lake, *F.;* Brattleboro, *Fr.*

H. **crista-castrensis** L. On soil and decaying logs, in cool, moist woods; common in mountainous regions.

H. **cupressiforme** L. Brattleboro, *Fr.*

H. **curvifolium** Hedw. Decaying log near Lye Brook, Manchester, *G.;* Brattleboro, *Fr.* Distinguished from *H. imponens* by its stouter cernuous costate capsule. The Manchester specimens are rather more slender than is usual with this species.

H. **cuspidatum** L. Marshy places. Brattleboro. *Fr.*

H. **eugyrium** Br. & Sch. Rocks near streams, Brattleboro, *Fr.;* mill stream below Mountain House, Jay Peak, *F.*; Smuggler's Notch, Dr. Kennedy.

H. **fertile** Sendt. Although often reported I have not yet seen any true *H. fertile* from Vermont.

H. **filicinum** L. Wet places. Williamstown Gulf, *F.;* Brattleboro, *Fr.;* Porter's Swamp, Colchester. *G.*

H. **fluitans** L. Bogs, summit of Mt. Mansfield, *F.*, *G.*

H. **Haldanianum** Grev. Common everywhere; in moist woods on decaying logs; easily recognized by its large cylindric capsules and inflated alar cells.

H. **imponens** Hedw. Decaying logs, stumps, etc., in moist woods. Monkton, *P.;* Peacham, *Bl.;* Brattleboro, Manchester, *G.;* Burlington, *Fr.* Easily distinguished by its regularly pinnate branching, falcatesecund leaves and cylindric, nearly erect capsule.

H. **molle** Dicks. Wet rocks. Mt. Mansfield, *G.*

H. **molluscum** Hedw. Moist places; Brattleboro. *Fr.*

H. **ochraceum** Turn. Brattleboro, *Fr.* In Gray Herbarium. Smuggler's Notch, Dr. Kennedy.

H. **palustre** Hedw. Limestone rocks, bed of brook, Brattleboro, *Fr.;* Peacham, *Bl.* *Vide* Lesq. & James, Mosses of North America, 399.

H. **pratense** Koch. On the ground in wet places. Milton Falls, and banks of the Lamoille River, Johnson, *G.;* Brattleboro, *Fr.*

H. **reptile** Mx. On decaying logs and stumps, in moist woods; not rare and distributed throughout the State.

H. **reptile protuberans**. Plants smaller and more slender; capsule shorter. In alpine and subalpine regions. Mt. Mansfield, *P.*

H. **revolvens** Swtz. Mt. Hor, *F.*

H. **Richardsoni** (Mitt.) L. & J. Shallow water in woods. Barnet, *Bl.*

H. **rugosum** L. Bluffs of Lake Champlain near Howard Park, Burlington, *G.*

H. **scorpioides** L. Cedar swamps, Willoughby region, Newark, and Sutton, *F.*

H. **stramineum** Dicks. Bogs, Johnson, *G.*

H. **Schreberi** Willd. On the ground in moist shady places. A very common and beautiful species.

H. **uncinatum** Hedw. On damp soil in moist mountain woods. Mt. Elmore and Mt. Mansfield, *G.;* Mt. Mansfield, *F.;* Brattleboro, *Fr.;* Willoughby, Mt. Hor, and Mt. Mansfield, *F.*

H. **vernicosum** Lindb. Swamps, Starksboro, *P.* "Seen by Lindberg himself." Borders of Porter's Swamp, Colchester, *G.;* ("Ad var. majus, Lindb. accedens") Det. F. Renauld.

H. **Wilsoni** Sch. var. **hamatum** (Br. & Sch.) Ren. (*H. aduncum var. hamatum* Br. & Sch.) Bog near Willoughby Lake, *F.;* Shelburne, *P.;* Det. F. Renauld. (In herb *F.* and *G.*)

## PLAGIOTHECIUM Br. & Sch.

| | |
|---|---|
| 1.—Leaves complanate. | 2. |
| Leaves equally spreading, straight. | **striatellum.** |
| 2.—Operculum rostrate. | 3. |
| Operculum convex or conic. | 4. |
| 3.—Leaves entire. | **sylvaticum.** |
| Leaves serrulate all around. | **deplanatum.** |

4.—Leaves entire. 3.
Leaves sharply serrate to the middle. turfaceum.
5.—Capsule obovate, campanulate when dry. Muellerianum.
Capsule oblong, constricted under the mouth when dry. denticulatum.

P. **denticulatum** (L.) Br. & Sch. On the ground and moist rocks in mountain regions. Mt. Mansfield, *P.*, *G.*, and *F.*; Monkton, *P.*; Johnson, *G.;* Brattleboro, *Fr.;* Westmore and Mt. Hor, *F.*

P. **deplanatum** (Sch.) Grout. (*Hypnum deplanatum* Sch.) Limestone cave east of High Bridge, Burlington, *G.*

This is one of the three new binomials in the list and is inserted because of the difficulty of making an intelligible key if retained in the position given it in the Manual.

P. **Muellerianum** Sch. On soil, Mt. Mansfield, *P.*

The specimen which is referred to this species is incomplete and the determination somewhat uncertain. In herb. C. G. Pringle.

P. **striatellum** (Brid.) Lindb. (*P. Muhlenbeckii* Br. & Sch.) Willoughby Mt., Mr. Hor, and Jay Peak, *F.;* Mt. Mansfield, *G.*

P. **sylvaticum** (Huds.) Br. & Sch. On earth and stones in moist and shady places. Mt. Mansfield and Charlotte, *P.;* Peacham, *Bl.;* Mt. Mansfield, and Stratton, *G.*

P. **turfaceum** Lindb. Oh decaying wood on borders of Porter's swamp, Colchester; submerged at high water, *G.;* on soil, Peacham, *Bl.;* Underhill Notch, *G.*

### RAPHIDOSTEGIUM( Br. & Sch.) De Not.

R. **recurvans** (Mx.) Jaeger & Sauerb. On trees and rotting logs. Monkton, Underhill, and Smuggler's Notch, *P.;* Stowe, *B.;* Peacham, *Bl.;* Brattleboro, *Fr.*

## Family XX. Brachytheciaceae.

### BRACHEYTHECIUM Br. & Sch.

1.—Costa extending into apex. 2.
Costa extending ½—⅔ length of leaf. 4.
2.—Seta rough throughout; plants slender. 3.
Seta nearly smooth at base; plants more robust. populeum.
3.—Plants very slender; leaf cell 3-5:1. reflexum.
Plants more robust; leaf cells 8-10:1. glaciale.
4.—Branch leaves entire. 5.
Branch leaves serrate. 6.

5.—Seta rough above. **plumosum**
Seta smooth throughout. **acutum.**
6.—Seta smooth. 7.
Seta more or less roughened. 10.
7.—Capsules 3-4:1, suberect. **oxycladon.**
Capsules 2-3:1, strongly inclined to horizontal. 8.
8.—Stem leaves gradually narrowed from base to slender apex. 9.
Stem leaves acuminate. **salebrosum.**
9.—Stem leaves lanceolate, 0.6 mm. broad. **flexicaule.**
Stem leaves triangular-ovate, 1 mm. broad. **acutum.**
10.—Seta rough above, nearly smooth below. 11.
Seta rough throughout. 12.
11.—Leaves plicate, long acuminate. **campestre.**
Leaves not plicate, shorter acuminate. **plumosum.**
12.—Cells of branch leaves 5:1, papillose by the thickened angles of the cell walls. **Novae-Angliae.**
Cells of branch leaves at least 8-1, smooth. 13.
13.—Secondary stems dendroid; leaves ovate and very short acuminate. **rivulare.**
Secondary stems not dendroid; leaves slender pointed. 14.
14.—Stem leaves lanceolate. **velutinum.**
Stem leaves ovate to triangular-ovate. 15.
15.—Cilia not appendiculate; plants yellow-green. **rutabulum.**
Cilia appendiculate; plants green, usually complanate-foliate. **Starkei.**

B. **acutum** (Mitt.) Sull. In swampy places and on moist earth. Monkton and Charlotte, *P.*

B. **campestre** Br. & Sch. On damp earth and stones in woods, Johnson, also southern Vermont, *G.;* Burlington. W. Danville, *Bl.* (In Herb. Univ. of Wisconsin.)

B. **flexicaule** Ren. & Card. On rocks in woods, Manchester, *G.* Det. Cardot.

B. **glaciale** Br. & Sch. Willoughby Mt., *F.*
This is the fourth station in North America for this plant.

B. **Novae-Angliae** (Sull. & Lesq.) Jaeger and Sauerb. On the ground and stones, in moist and shady places, especially in mountainous regions. Stowe, *B.;* Johnson, *G.;* Brattleboro, *Fr.;* Underhill, *P.*

B. **oxycladon** (Brid.) Jaeger & Sauerb. (*B. laetum.* Br. & Sch.) On the ground, roots of trees, and rocks in woods.
Stowe, *B.;* Burlington, Underhill Notch, and Newfane, *G.*

B. **oxycladon dentatum** (L. & J.) Grout. Swamp, Monkton, *P.*

B. **plumosum** (Sw.) Br. & Sch. On stones in brooks and moist rocks in woods. Camel's Hump, Mt. Mansfield, and Monkton, *P.;* Stratton and Newfane, *G.;* W. Barnet, *Bl.;* Brattleboro, *Fr.*

B. **populeum** (Hedw.) Br. & Sch. Waverley Cascades, *B.;* Manchester and Newfane, *G.*

B. **populeum ovatum** Grout. On rocks in woods with *Grimmia apocarpa*, Johnson, *G.;* Peacham, *Bl.*

B. **reflexum** (Starke) Br. & Sch. In mountainous regions, on decaying logs, roots of trees and less frequently on the soil. Stratton and Newfane, *G.;* Southwest Vermont and Mt. Mansfield, *P.;* Willoughby, *F.*

B. **rivulare** Br. & Sch. Subaquatic, in swamps and wet places. Peacham and Ryegate, *Bl.;* Underhill, *P.;* Brattleboro, *Fr.*; Mt. Hor, *F.*

B. **rutabulum** (L.) Br. & Sch. On the ground and stones in wet places. Stowe, *B.;* Monkton, *P.*

B. **salebrosum** (Hoffm.) Br. & Sch. On earth and stones, roots and trunks of trees in woods. Stowe, *B.;* Charlotte, *P.;* W. Barnet, *Bl.;* Mt. Mansfield, *G.;* Brattleboro, *Fr.*

B. **Starkei** (Brid.) Br. & Sch. On decaying logs and stumps in woods, especially in mountainous regions. Mt. Mansfield, Stratton and Johnson, *G.;* Peacham, *Bl.*

B. **velutinum** (L.) Br. & Sch. On soil, in moist, shady places. Stowe, *B.;* Newfane, *G.*; Brattleboro, *Fr.* It is stated on the label in Frost's collection that this species was discovered in America for first time by C. C. Frost at Brattleboro.

## CAMPTOTHECIUM Br. & Sch.

C. **nitens** (Schreb.) Schimp. Moist meadows, Willoughby Lake, *F.*

## EURHYNCHIUM Br. & Sch.

| | |
|---|---|
| 1.—Seta rough. | 2. |
| Seta smooth. | **strigosum.** |
| 2.—Branch leaves cucullate at apex, abruptly long filiform acuminate. | **piliferum.** |
| Branch leaves acute to almost obtuse. | **hians.** |

E. **piliferum** (Schreb.) Br. & Sch. On the ground and base of trees in woods and shady meadows. "Vermont" *Fr.;* Burlington, Carey. In the Gray Herbarium.

E. **strigosum** (Hoffm.) Br. & Sch. On soil in moist and shady places. Monkton, *P.;* Willoughby, *F.;* Brattleboro, *Fr.;* Dorset Mt., *G.*

E. **hians** (Hedw.) Jaeger & Sauerb. Rock Point, Burlington, *G.;* "Cold Brook," Willoughby, *F.*

HOMALOTHECIUM Br. & Sch.

H. **subcapillatum** (Hedw.) Sulliv. On trees. Brattleboro, *Fr.*

MYUROCLADA Bescherelle.

M. **Boscii** (Schwaegr.) Besch. (*Hypnum Boscii.* Schwaegr.) On soil in woods and meadows. Seldom fruiting. Brattleboro, *Fr.*

POROTRICHUM Brid.

(*Thamnium* Br. & Sch.)

P. **Alleghaniense** (C. Muell.) Rocky margins of rivulets, Brattleboro, *Fr.* The specimen in Frost's harbarium, though not examined microscopically appears to be this species. Woodstock, Miss Soule. In Herb. Faxon.

Pororotrichum evidently does not belong in this family but is left here because of the uncertainty as to its true position.

RHYNCHOSTEGIUM Br. & Sch.

| | |
|---|---|
| Leaves apparently two ranked; plants of dry woods. | **serrulatum.** |
| Leaves spreading every way; growing on stones in brooks. | **rusciforme.** |

R. **rusciforme** (Neck.) Br. & Sch. On stones in brooks. Underhill and Bakersfield, *P.;* Newfane, *G.*

R. **serrulatum** (Hedw.) Jaeger & Sauerb. On the ground in dry woods. Brattleboro, *Fr.*

Family XXI. ISOTHECIACEAE Spruce.

CLIMACIUM Web. & Mohr.

| | |
|---|---|
| 1.—Capsules 3-4:1; median leaf cells 10:1. | **dendroides.** |
| Capsules 5-6:1; median leaf cells 2-7:1. | **Americanum.** |

C. **Americanum** Brid. Swamps, wet soil, and rocks, sometimes growing on cliffs; common but rarely fruiting.

C. **Americanum Kindbergii** Ren. & Card. In swampy places. Stowe, *B.*

C. **dendroides** (L.) Web. and Mohr. Common in swamps in northern Vermont. Milton and Johnson, *G.*; Castleton, Eggleston.

## ENTODON C. Muell.

(*Cylindrothecium* Br. & Sch.)

1.—Teeth of peristome conspicuously hyaline margined. **repens.**

Teeth not hyaline margined. 2.

2.—Very broadly complanate foliate; annulus of large cells. **cladorrhizans.**

Nearly terete foliate, annulus of narrow cells. **seductrix.**

E. **cladorrhizans** (Hedw.) C. Muell. On decaying wood and base of trees in moist shady places; frequent.

E. **repens** (Brid.) Grout. (*Platygyrium repens*, Br. & Sch.) Rotting logs in moist woods. Rock Point, Burlington, *G.;* Mt. Hor cliffs, *F.*

E. **seductrix** (Hedw.) C. Muell. On decaying wood and moist soil. Brattleboro, *Fr.*

## PYLAISIELLA Kindb.

(*Pylaisia* Br. & Sch.)

Segments of endostome partially adherent to teeth, free at the apex; spores 0.018—0.024 mm. **intricata.**

Segments wholly adherent; spores 0.026—0.030 mm. **velutina.**

P. **intricata** (Hedw.) Grout. On bark of living trees; common.

P. **velutina** (Schimp.) Kindb. Killington Peak, Mrs. Laura Morgan. (In Herb. Frost as *P. polyantha.*)

### Family XXII. Fabroniaceae.

## ANACAMPTODON Brid.

A. **splachnoides** (Froelich.) Brid. On an old yellow birch, Smuggler's Notch, Dr. Kennedy. In Herb. U. V. M. This moss has a peculiar habit of growing around old knot holes and similar cavities in wood.

### Family XXIII. Neckeraceae.

## HOMALIA Brid.

H. **Jamesii** Schimp. Base of Mt. Hor cliffs, *F.*

## LEPTODON Mohr.

L. **trichomitrion** (Hedw.) Mohr. Trees in woods, Brattleboro, *Fr.*
I regard Frost's specimens as doubtfully this species.

### NECKERA Hedw.

| | |
|---|---|
| Branches attenuate, often flagelliform. | oligocarpa. |
| Branches obtuse, never flagelliform. | pennata. |

**N. oligocarpa** Bruch. On trees. Willoughby, Dr. Kennedy. In herb. A. J. G. & Dr. K.

**N. pennata** (L.) Hedw. On trunks of trees; common in mountainous regions.

## Family XXIV. CRYPHAEACEAE.

### LEUCODON Schwægr.

| | |
|---|---|
| Leaves entire, slender pointed; median cells linear-vermicular. | sciuroides. |
| Leaves serrulate and broader at apex; median cells broader and shorter. | brachypus. |

**L. brachypus** Brid. Trunks of beech trees, in mountains. Manchester, *G.*; Underhill, *P.*; Willoughby region, Mt. Hor and Ferrisburgh, *F.*

**L. sciuroides** (L.) Schwaegr. On trees. Willoughby, Dr. Kennedy; Mt. Hor. *F.*

## Family XXV. FONTINALACEAE.

### FONTINALIS Dill. L.

| | |
|---|---|
| 1.—Leaf cells rhombic-hexagonal, 6:1 or less. | 2. |
| Leaf cells long linear, 7-30:1. | 4. |
| 2.—Plants very robust; branches markedly triangular-prismatic. | antipyretica gigantea. |
| Plants much more slender and scarcely triangular-prismatic. | 3. |
| 3.—Female flowers abundant, in most leaf axils. | Novae-Angliae. |
| Female flowers rare, at base of stems. | biformis. |
| 4.—Leaves concave and incurved on the borders. | Dalecarlica. |
| Leaves plane or concave, not incurved. | 5. |
| 5.—Alar cells very large. | Sullivantii. |
| Alar cells moderately or not at all enlarged. | Lescurii. |

**Fontinalis antipyretica** L. var. **gigantea** Sulliv. Cold brooks. Brattleboro, *Fr.;* Johnson, *G.;* Peacham, *Bl.*

**F, biformis** Sulliv. Found in New Hampshire and Massachusetts by Faxon, and reported from Vermont by Frost.

**F. Dalecarlia** Br. & Sch. Mountain brooks. Underhill, *P.;* Brattleboro, *Fr.* ; Newfane, *G.*

**F. Lescurii** Sulliv. Enosburgh, *P.;* Elmore Pond, *G.;* Willoughby Lake region, *P.*

F. **Novae-Angliae** Sulliv. Little Otter Creek, Ferrisburgh, *F.*

F. **Sullivantii** Lindb. Brattleboro, *Fr.* *Vide* Lesq. & James, Mosses of North America, 271.

The following list of mosses has been reported from Vermont by Frost but no specimens of these species have been found either in his herbarium at Brattleboro or in the Gray (Sullivant) Herbarium, which Dr. Robinson has very kindly searched for me:

Bruchia flexuosa Muell.
Fissidens minutulus Sulliv.
Leptotrichum vaginans Lesq. & James.
Grimmia Pennsylvanica Schwaegr.
Atrichum crispum James.
Dichelyma capillacea Br. & Sch.
Pterigynandrum filiforme Hedw.
Hypnum (Thuidium) gracile Br. & Sch.
Hypnum (Thuidium) minutulum Hedw.
Hypnum demissum, Wils.
Hypnum (Plagiothecium) Sullivantiae Schimp.

Many of these undoubtedly occur in the State and will be found again sooner or later.

Bryum pseudotriquetrum was also reported by Frost and in the Gray Herbarium is a specimen labelled "Bryum pseudotriquetrum? Brattleboro, Frost." On examination of this specimen it seemed very doubtfully this species and consequently it is not included in the list.

## APPENDIX.

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The author greatly regrets that he did not sooner know of the great amount of work done on Vermont mosses by Dr. George G. Kennedy of Readville, Mass. It has been possible to introduce into the text most of his additions but a large number of localities which should have been credited to him came too late to be inserted.

* * * * * * * *

Mrs. Britton informs us that Dr. Frost's **Physcomitrium pyriforme** is in all probability **P. turbinatum** (Mx.) Brid.

* * * * * * * *

### POLYTRICHUM L.

(Change 4 of key to 5 and insert the following as 4.)

**4 —Terminal cell of the lamellae flat topped or notched in section broader than high. 5.**

**Terminal cell of lamellae rounded, higher than broad. gracile.**

**P. gracile** Dicks. Swamp, Willoughby region, Dr. Kennedy. In herb. Dr. K. and *G.*

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